# Survey of Diffusion of Technology in the Mining Industry

**Industry, Science and Technology Canada,**
Information Technologies Industry Branch

**CANMET,**
Energy, Mines and Resources Canada

**Communications Canada**

**Statistics Canada,**
Small Business and Special Surveys Division

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*Industry, Science and Technology Canada*

*Canada Centre for Mineral and Energy Technology (CANMET)*

*Communications Canada*

*Statistics Canada*

*June 1990*

## FOREWORD

The capacity of Canadian firms to adopt and diffuse technology has a considerable impact on their ability to remain competitive. To quote from a landmark study "companies that refuse advanced information technologies will find themselves left behind by their competitors. Introducing new information technologies will be a competitive necessity in the 1990's." Technological change is a crucial means to economic advancement. It is the key to improvements in productivity, global competitiveness, and ultimately, employment. Rapid adoption of new technologies is vitally important to future prosperity.

This survey provides up-to-date information on the current and planned use of computer-based technologies and applications within Canada's mining sector. It is intended to help industry appraise its current and projected use of selected technologies. It provides the mining industry, as well as technology developers, with useful information on the future implementation of widely used and emerging technology applications.

It was evident from the survey results that 235 Canadian mines are riding the "wave of technological change", of which two-thirds have seen positive improvements in productivity, more than half have realized improved product quality; and two-thirds have experienced a reduction in operating costs.

The fact that more than three quarters of the mines surveyed use one or more of the 28 specified advanced technologies indicates the extent to which the traditionally conservative mining industry has so far, perceived and sounded these technologies. There is ample evidence to show that the industry is very aware that technology transfer is the key to unlocking the enormous potential of these technologies and that the wholesale adoption of computerized information and technical control systems is accelerating very quickly.

This report highlights the major findings of the survey of Diffusion of Technology in the Mining Industry. It is the result of cooperation between several government departments; Industry, Science and Technology Canada, Canada Centre for Mineral and Energy Technology (CANMET), Communications Canada, and Statistics Canada who conducted this survey. The report was prepared by François Bolduc, Michael Clapham, Don Doyle, Michael Issa, Beverley Mahony and Jay Pathak.

## SURVEY OF DIFFUSION OF TECHNOLOGY IN THE MINING INDUSTRY

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## INTRODUCTION

The survey of Diffusion of Technology in the Mining Industry is the first national survey conducted by Statistics Canada to measure the degree of utilization of computer based technologies for all mining operations in Canada.

Twenty-eight advanced technologies and applications were surveyed in January 1990. They fell into four general categories: automated material handling; communications and networks; control; and automated processing systems. Respondents were asked to indicate both the use and planned use of the selected technologies, the level of satisfaction in their use as well as an evaluation of the impact of the introduction of these technologies on output, on quality and on costs. The questionnaire was mailed to all 324 known mines in Canada. A response rate of 97% was achieved indicating the great interest of the mining industry in advanced technology. Inactive mines or mines engaged solely in exploration were excluded leaving 235 useable responses.

This survey is a combined effort of Industry, Science and Technology Canada; Canada Centre for Mineral and Energy Technology (CANMET), Communications Canada; and Statistics Canada.

## HIGHLIGHTS

- **Use of advanced mining technologies**

  Over half (52%) of operating mines (representing 85.2% of total employment in the mining industry) use at least 5 of the 28 advanced technologies. However when we consider the use of 15 technologies or more the numbers drop significantly to 19% of the mines (accounting for 49% of total employment in the industry). This is illustrated in chart 1.

- **Leading technologies**

  The leading technologies were: programmable logic controllers (78%), automatic bin level measurement (77%), flow density measurement (74%), and analog controllers (72%). This reflects the progression from the analog to the digital techniques.

- **Less used technologies**

  Less frequent use was made of the following technologies: automated T.V. image analysis (19%), on-stream size analysis (28%), near-stream analysis (25%), and open pit data communication networks (24%).

- **Planned use of technologies**

  Respondents were asked to identify if they planned to increase current usage of the technologies surveyed. Significant growth is planned in the next three years in underground data communication networks (64%), programmable logical controllers (50%), supervisory control and data acquisition (49%), integrated expert systems for process control (49%), and on-line statistical process control (48%). Respondents not currently using the technologies identified the following top three technologies they were planning to adopt in the next three years: on-line statistical process control (28%), interactive expert systems for process control (20%), and in-plant data networks linking automated processes (14%).

- **Expectations met or exceeded**

  Overall satisfaction with the technologies surveyed was very high. Over 80% of respondents felt their expectations have been met or exceeded, except for automated bin level measurement where 26% felt their expectations were not met.

- **Use by industry**

  Nickel-copper mines, iron mines, potash mines and copper and copper-zinc mines were the most likely to have introduced advanced technologies. Salt mines, gypsum mines, other metal mines, and other non-metal mines had the lowest incidence of technology use (see chart 2).

- **Use by size of mine**

  Large mines, those employing over 250 employees, made significantly greater use of the technologies, while mines with under 50 employees hardly used the technologies (see chart 3).

- **Use by Province**

  Mining establishments in Ontario, New Brunswick, Saskatchewan, the Northwest Territories, British Columbia and Manitoba had the highest rate of utilization of advanced technologies (see chart 4).

- **Ownership**

  There is no clear overall trend in the use of technologies between Canadian owned mines and mines owned by the United States. However Canadian mines made greater use of control technologies (see chart 5).

- **Age of mine**

  The number of years the mine has been in operation appears to be a factor influencing the use of these technologies. Mines in operation for under 5 years use the technologies less, which reflect the small amount of ores reserves and the use of older refurbished equipment (see chart 6).

- **Impact on output, product quality, and costs**

  Almost two out of three mines (63%) improved their output by introducing the technologies. The highest impact was in iron mines (100%), other metal mines (100%), copper and copper-zinc mines (89%), silver-lead-zinc mines (88%) and potash mines (70%).

  Over one out of every two mines (56%) experienced improved product quality by adopting advanced computer based technologies. This was most evident in the following industries: iron (100%), nickel-copper (100%), copper and copper-zinc (78%), silver-lead-zinc (75%), other metal mines (75%), and uranium mines (71%).

  Almost two out of every three mines surveyed (65%) experienced a reduction in costs by the introduction of the new technologies; in 27% there was no change in costs while in 9% there was an increase in costs. Decreased costs due to technology use were prevalent in the following mining industries: iron (100%), silver-lead-zinc (100%), asbestos (100%), copper and copper-zinc (88%), uranium (86%), potash (82%), and nickel-copper (80%). Five mining industries responded that they had experienced an increase in costs due to the introduction of the new technologies, these were: gypsum (22%), coal (20%), other non-metal (19%) gold (11%), and copper and copper-zinc mines (6%).

  There was a positive correlation between increased use of technology and its beneficial impact on output, quality and costs (see chart 8).

## PRESENTATION OF TABLES

The tables are presented in two formats, with each version presented opposite the other. One format presents the results **weighted by mines**, each mine represents one unit irrespective of size. The other table format presents the percentages **weighted by the number of employees** working in the mine. This method adjusts the technology use by the size of the mine's operation as reflected by its employment.

The results were tabulated by industry (Gold, Copper and Copper-Zinc, Nickel-Copper, Silver-Lead-Zinc, Uranium, Iron, Other Metal, Asbestos, Gypsum, Potash, Salt, Other Non-Metal (except coal), and Coal), by province, by mining method, by ownership, by size and by age of operation.

To simplify the presentation of the tables some headings had to be abbreviated, i.e. "plan to use" or "plan to increase usage" refer to **the next three years**. A copy of the questionnaire used is provided on the next page. It shows the complete description of the technologies and applications surveyed as well as the detailed questions asked.

SYMBOLS USED IN THE TABLES

- \- zero
- x confidential

Statistics Canada / Statistique Canada

# DIFFUSION OF TECHNOLOGY SURVEY IN THE MINING INDUSTRIES

**IMPORTANT**
**Please complete and return within 10 days of receipt.**

>> PLEASE REPORT ONLY FOR THE ABOVE SPECIFIED MINING LOCATION.

Collected under Authority of Statistics Act, Revised Statutes of Canada, 1985, Chapter S19.

Si vous préférez recevoir ce questionnaire en français, veuillez téléphoner à frais virés ou cocher la case ☐

## PURPOSE OF THE SURVEY

Studies have indicated that Canada lags behind most other advanced economies in the use of computer-based technologies. The purpose of this survey is to provide up-to-date information on the current and planned use of computer-based technologies and applications in the mining industry. This data will be important to the federal government in policy formulation and program planning to promote the diffusion of computer-based technologies.

## SPONSOR

This survey is conducted by Statistics Canada on behalf of Industry, Science and Technology Canada, Departments of Communications and Energy, Mines and Resources/CANMET.

## PARTICIPATION

Participation in this survey is voluntary. Your cooperation in completing the questionnaire, however, is vital for the statistical information to be useful and valuable.

## SCOPE

The manager is asked to provide a single response on the form provided, which is representative of these technologies used in your mining and milling operations.

## CONFIDENTIALITY

Statistics Canada is prohibited by law from publishing or releasing outside Statistics Canada, in any manner, any statistics which would divulge information obtained from this survey relating to any identifiable business. The data reported on the survey questionnaire will be treated in strict confidence, used for statistical purposes and released in aggregate form only. The confidentiality provisions of the Statistics Act are not affected by either the Access to Information Act or any other legislation.

## CORRESPONDENCE

**If you require assistance in the completion of the questionnaire or have any questions regarding the survey**, please contact one of the offices below:

| St. John's | Montreal | Toronto |
|---|---|---|
| 1-800-563-4255 | 1-800-363-6720 | 1-800-387-0730 |
| (709) 772-4048 | (514) 283-5724 | (416) 973-6598 |

| Halifax | Sturgeon Falls | Winnipeg |
|---|---|---|
| 1-800-565-1685 | 1-800-461-1662 | 1-800-665-3393 |
| (902) 426-8100 | (705) 753-4888 | (204) 983-2773 |

| Edmonton | Vancouver |
|---|---|
| 1-800-661-9884 | 1-800-663-0172 |
| (403) 495-4627 | (604) 666-2649 |

| Name of person filling out questionnaire (Please print) | Telephone number<br>Area code |
|---|---|
| | |

5-4400-21: 30-11-89 STC/END-310-02761

Canada

## SECTION A - TECHNOLOGY USE

| DO YOU USE ANY OF THE TECHNOLOGIES BELOW? | IF YES | | | | | IF NO | |
|---|---|---|---|---|---|---|---|
| For each of the technologies listed below, mark x in the appropriate column. | Currently used in operations | Plan to increase current usage in next 3 years | Have your expectations of these technologies been: (check one) | | | Plan to use in next 3 years | |
| | | | met | not met | exceeded | Yes | No |
| **1. AUTOMATED MATERIAL HANDLING** | | | | | | | |
| 1.01 Automatic bin level measurement feed/withdrawl | | | | | | | |
| 1.02 Automatic conveyer systems: -sequential analog | | | | | | | |
| -computer control | | | | | | | |
| 1.03 Automatic slurry pumping systems: -stop/select | | | | | | | |
| -variable speed | | | | | | | |
| 1.04 Automatic computer control handling equipment: -ores | | | | | | | |
| -slurries | | | | | | | |
| -concentrates | | | | | | | |
| -reagents | | | | | | | |
| 1.05 Computer controlled vehicles & equipment | | | | | | | |
| 1.06 Computer based vehicle & equipment maintenance | | | | | | | |
| **2. COMMUNICATIONS & NETWORKS** | | | | | | | |
| 2.01 Radio based voice networks: -open pit mines | | | | | | | |
| -underground mines | | | | | | | |
| 2.02 Data communication networks in open pit mines | | | | | | | |
| 2.03 Underground data communications network | | | | | | | |
| 2.04 In plant data networks linking automated processes | | | | | | | |
| **3. CONTROL** | | | | | | | |
| 3.01 Analog controllers | | | | | | | |
| 3.02 Programmable logic controllers (PLC) | | | | | | | |
| 3.03 On-line statistical process control (SPC) | | | | | | | |
| 3.04 Supervisory control & data acquisition (SCADA) | | | | | | | |
| 3.05 Interactive expert systems for process control | | | | | | | |
| 3.06 Automated environmental monitoring & control | | | | | | | |
| 3.07 Automatic T.V. image analysis | | | | | | | |
| **4. AUTOMATED PROCESSING SYSTEMS** | | | | | | | |
| 4.01 Near stream analysis | | | | | | | |
| 4.02 On-stream analysis (XRF) | | | | | | | |
| 4.03 On-stream size analysis | | | | | | | |
| 4.04 Flow/density measurement | | | | | | | |
| 4.05 Inventory measurement | | | | | | | |

## SECTION B - IMPACT

| How did the introduction of the new technologies affect the following factors: | Increased | Decreased | No Change |
|---|---|---|---|
| Output | | | |
| Product quality | | | |
| Costs | | | |

## SECTION C - TYPE OF MINING, OWNERSHIP & EMPLOYMENT

1. Mining method: ☐ Selective ☐ Bulk

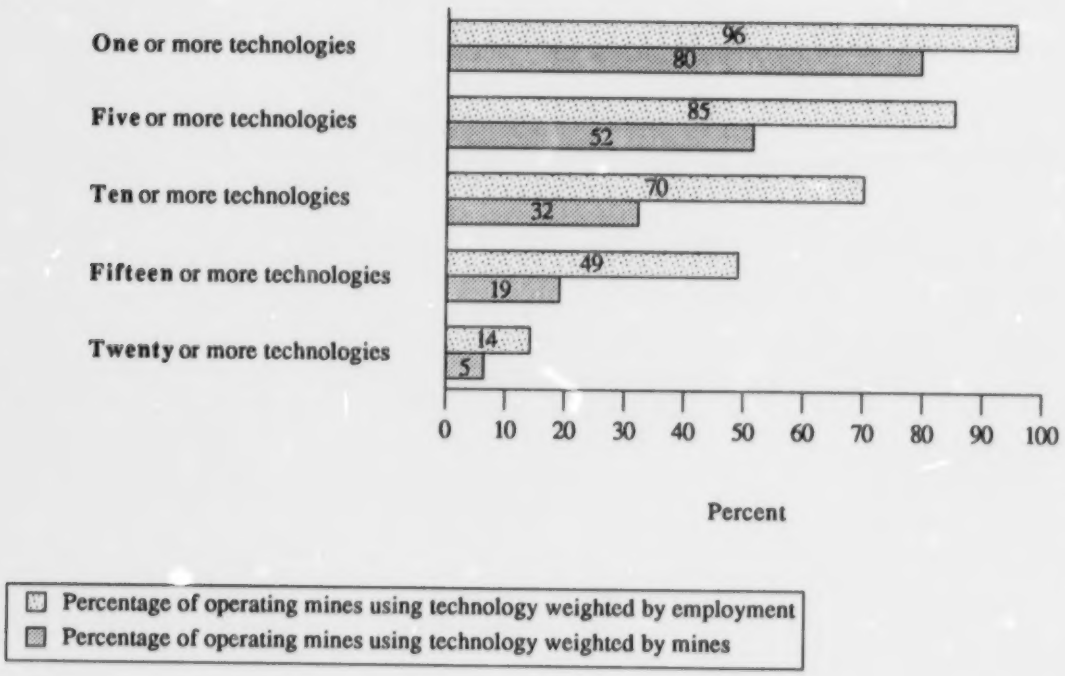
2. Is this establishment: ☐ Canadian owned ☐ U.S. owned ☐ Other

3. Number of employees at this address: _____

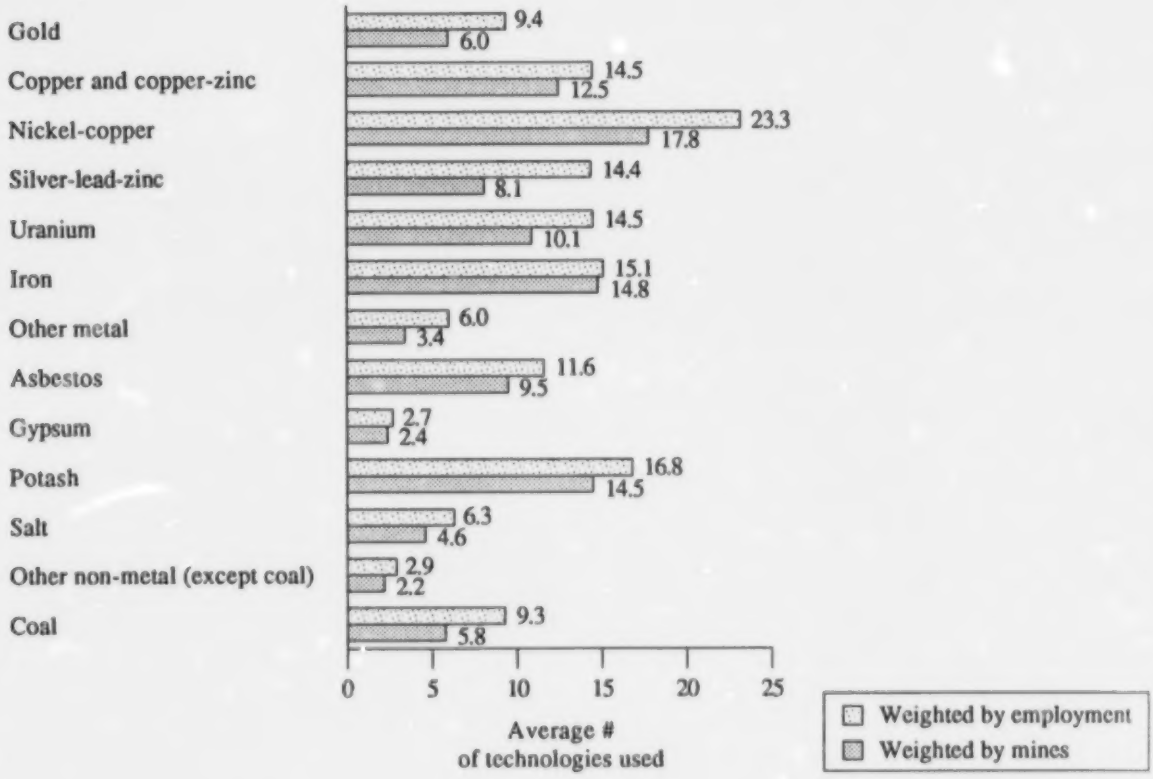
4. Age of mining operation: ☐ 0 - 5 years ☐ 6 - 10 years ☐ 11 - 15 years ☐ 16 - 20 years ☐ over 20 years

# Charts

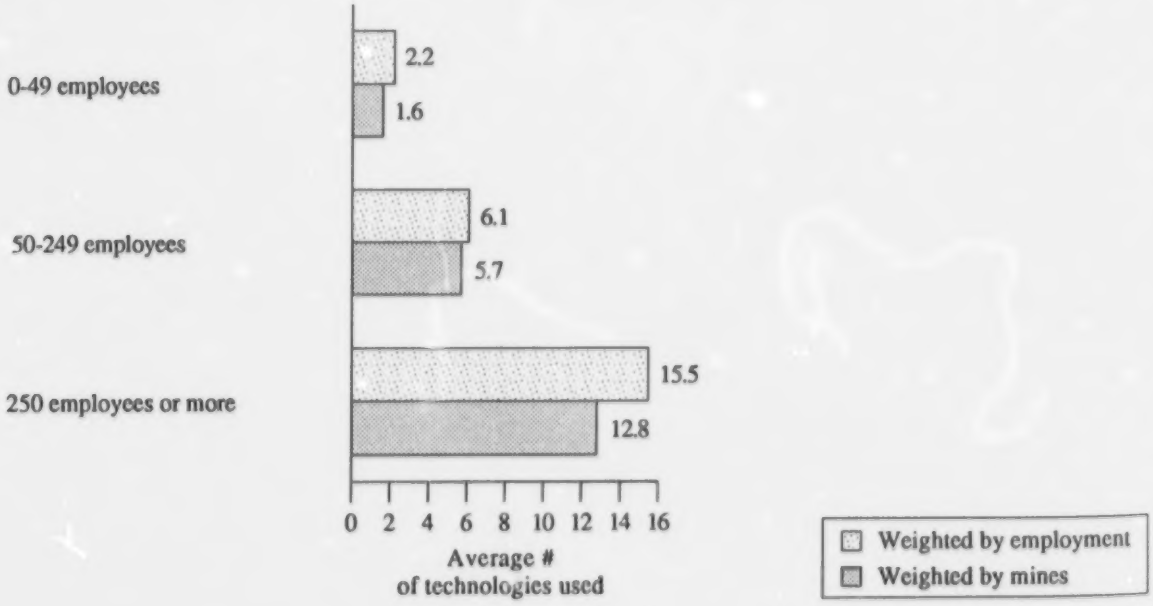
## Chart 1. Use of advanced mining technology



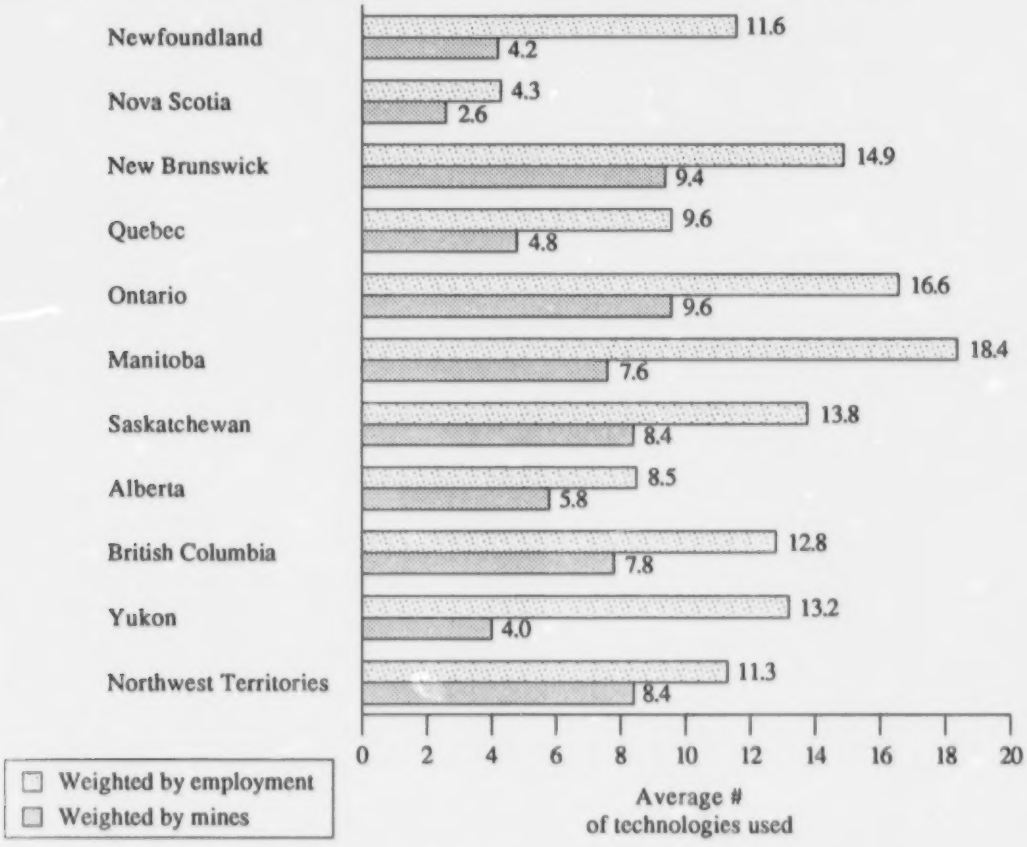
## Chart 2. Average number of technologies used by industry



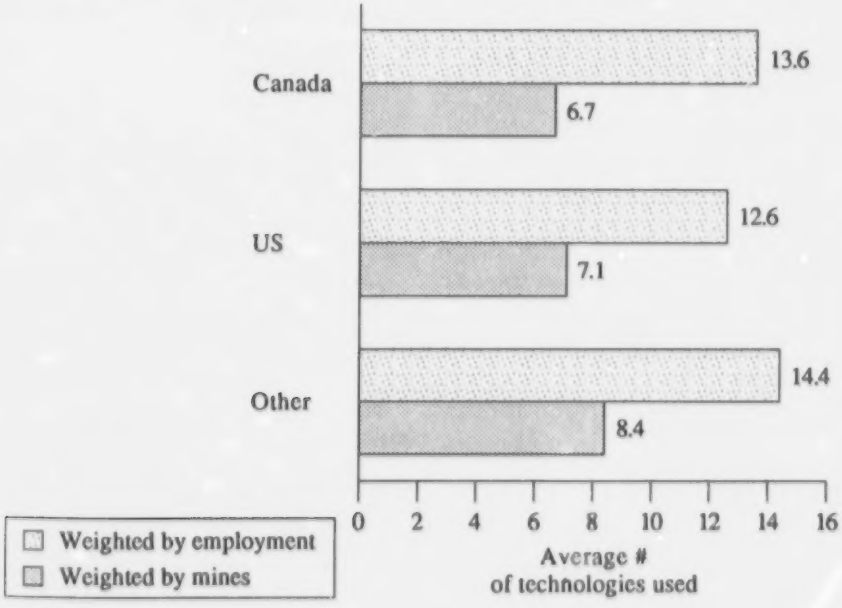

## Chart 3. Average number of technologies used by size of mine



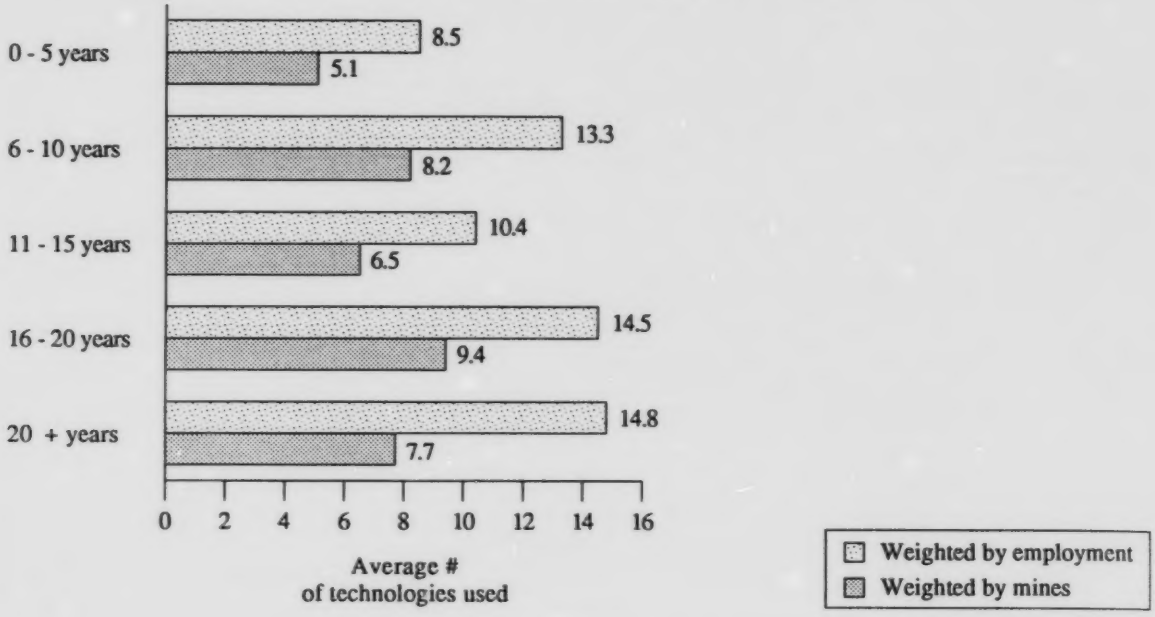
## Chart 4. Average number of technologies used by province



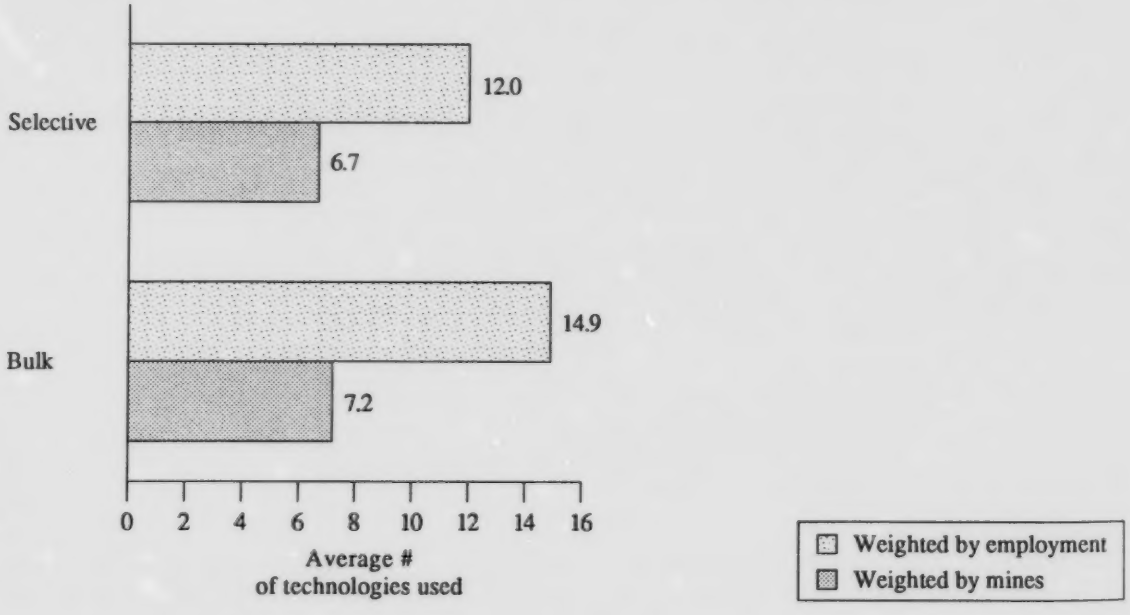

## Chart 5. Average number of technologies used by ownership



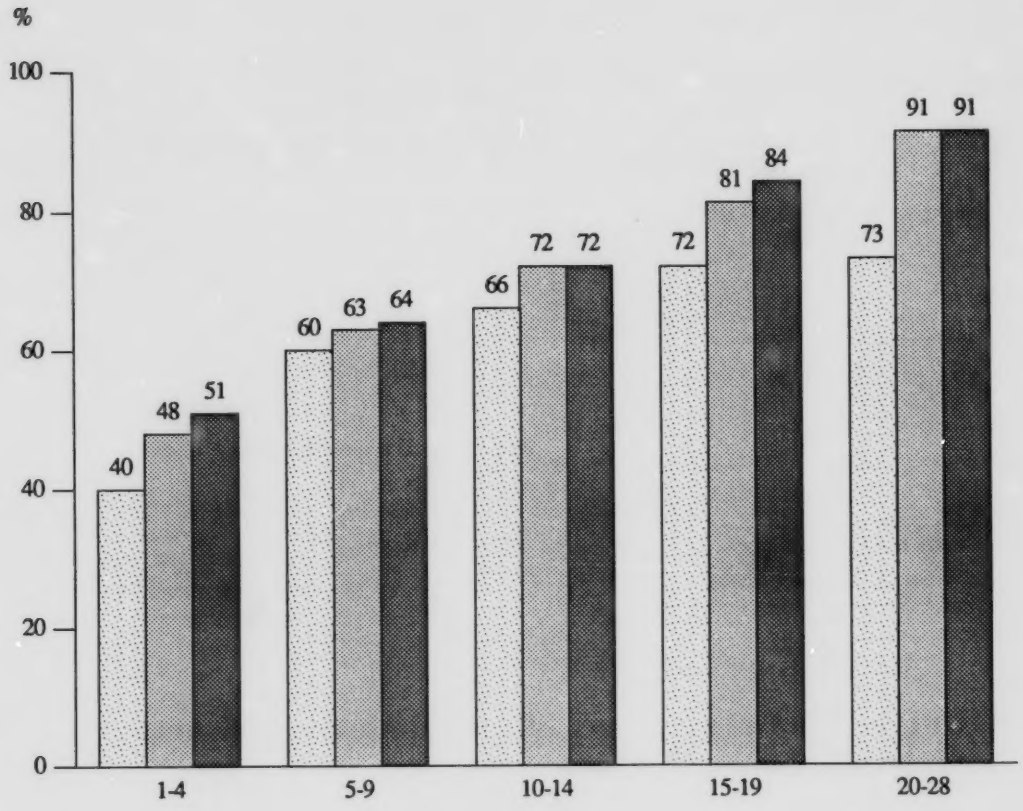
## Chart 6. Average number of technologies used by age of mine



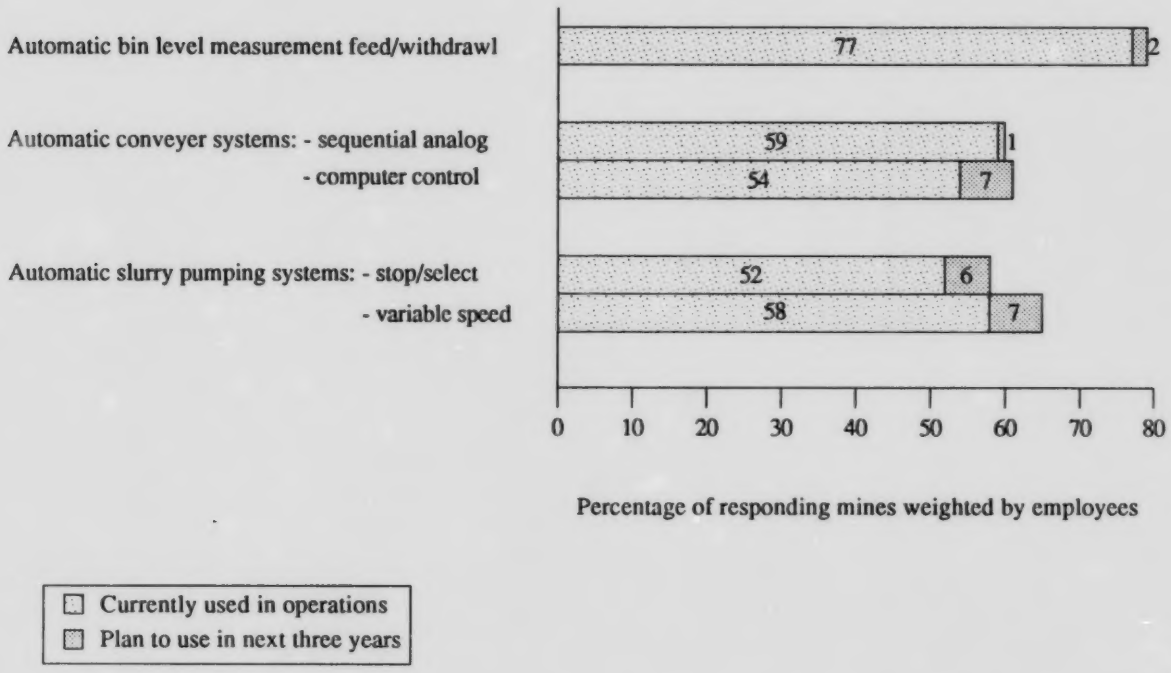

## Chart 7. Average number of technologies used by mining method



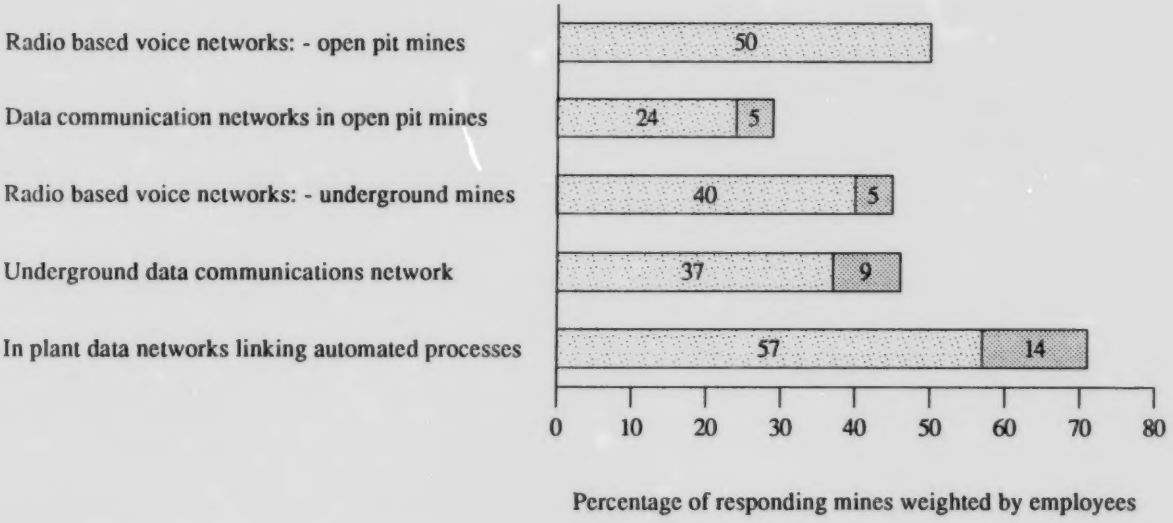
## Chart 8. Impact based on the number of technologies introduced



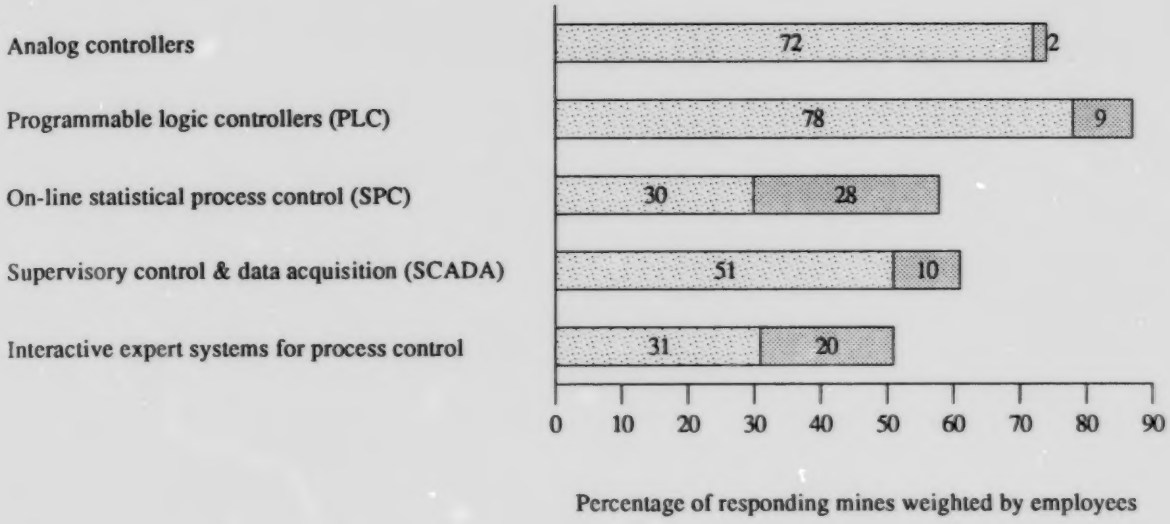
## Chart 9. Current and planned use of automated material handling technologies



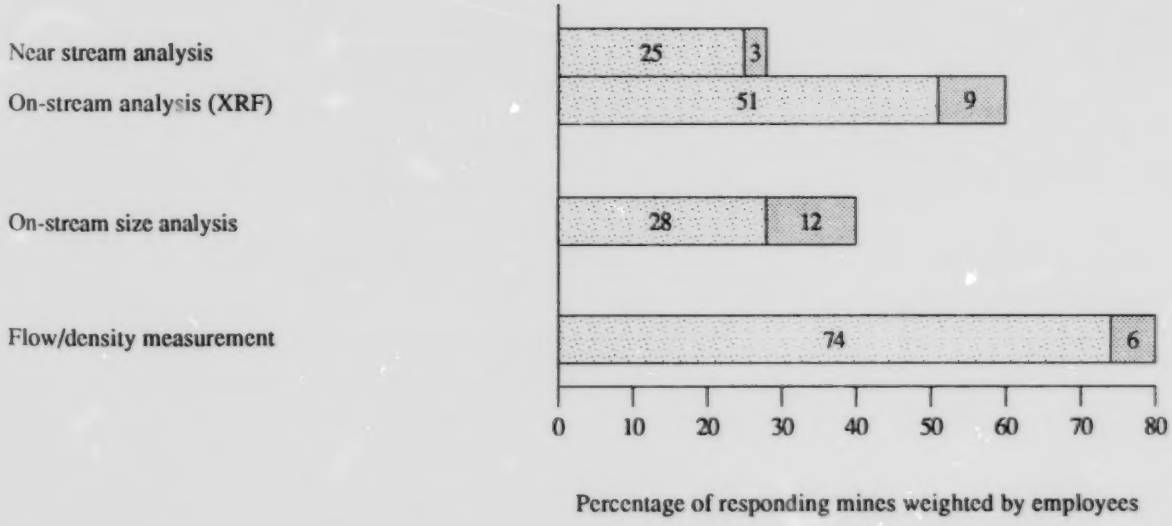

## Chart 10. Current and planned use of communications & networks technologies



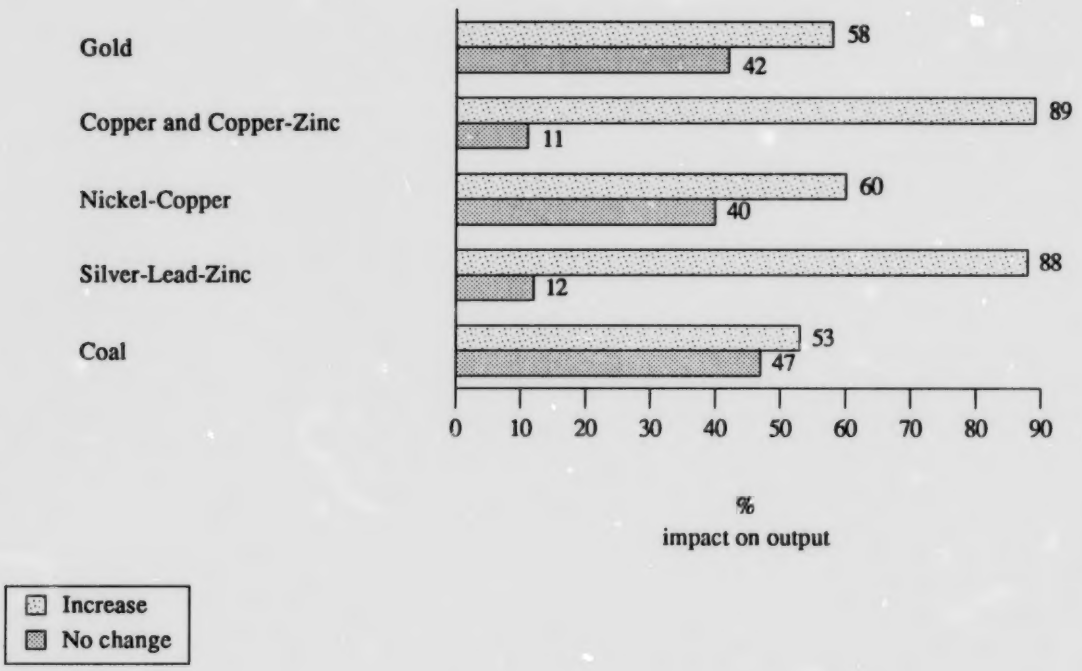
## Chart 11. Current and planned use of control technologies



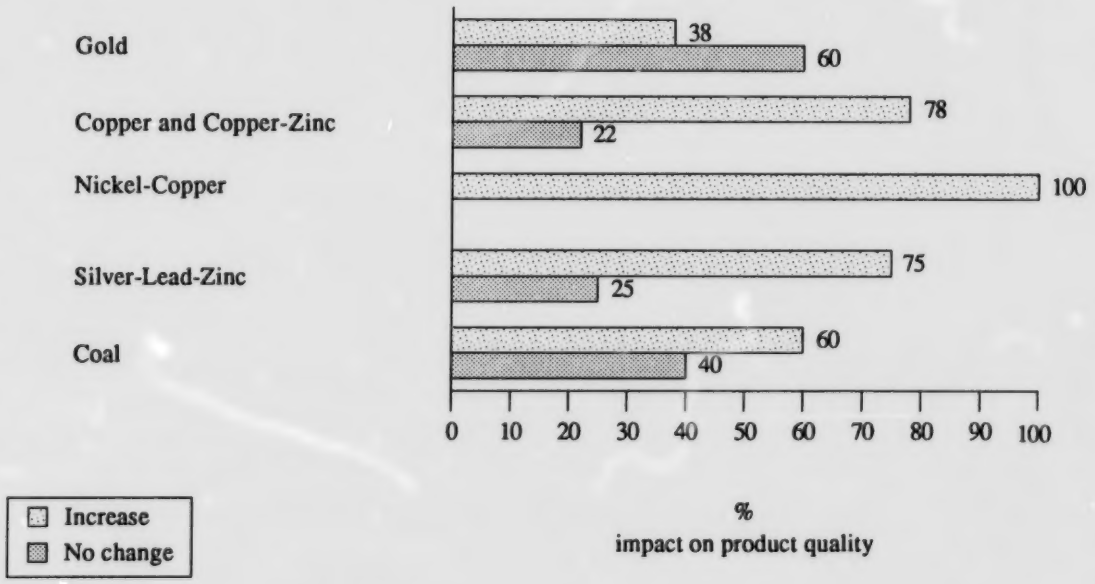

## Chart 12. Current and planned use of automated processing systems technologies



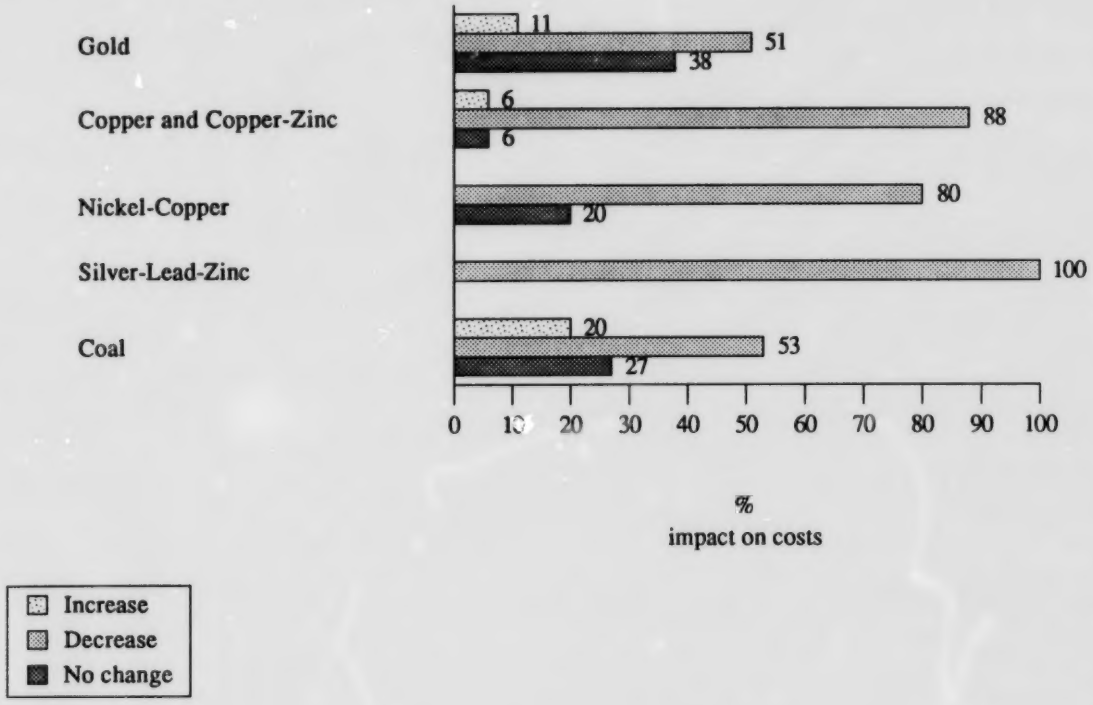
## Chart 13. Impact of the introduction of technologies on output by industry



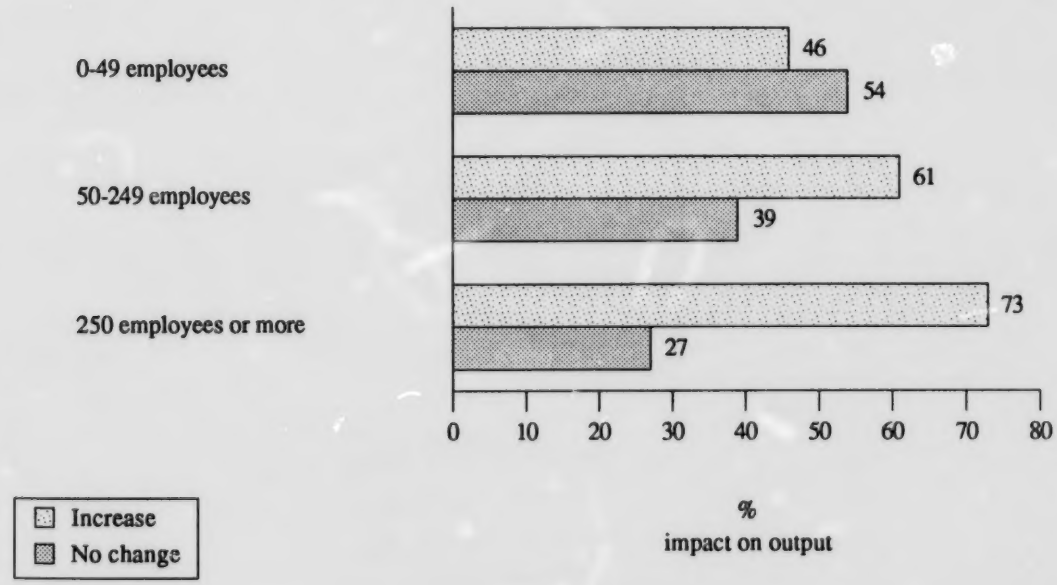

## Chart 14. Impact of the introduction of technologies on product quality by industry



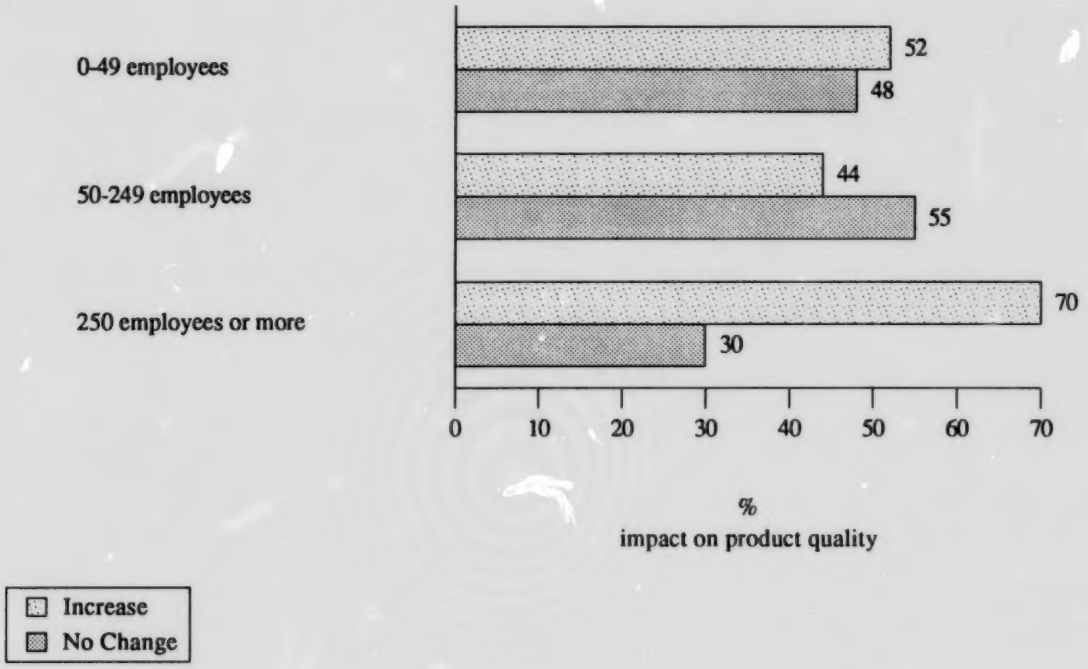
## Chart 15. Impact of the introduction of technologies on costs by industry



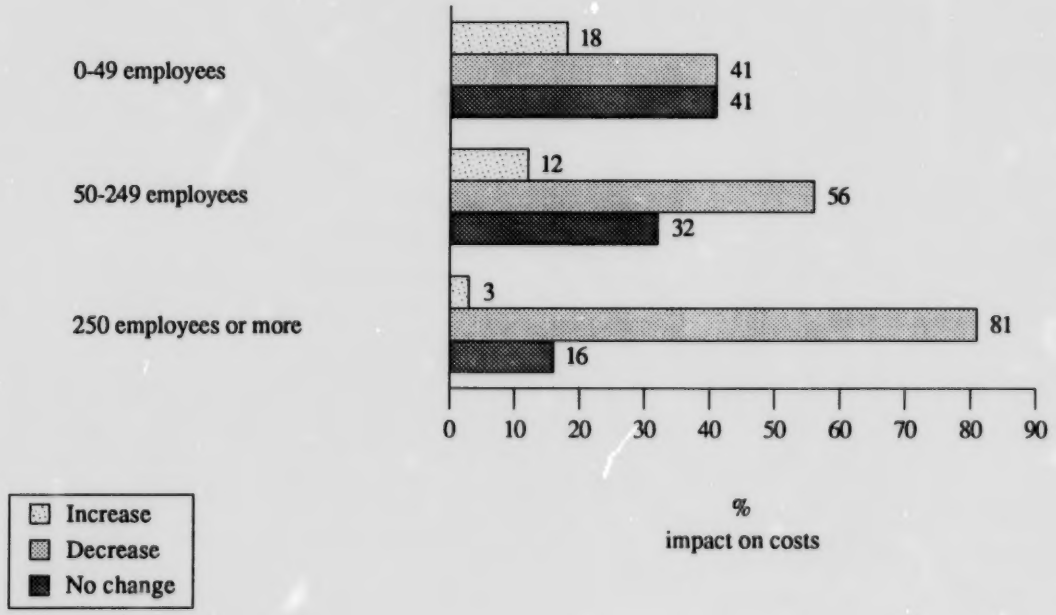

## Chart 16. Impact of the introduction of technologies on output by size



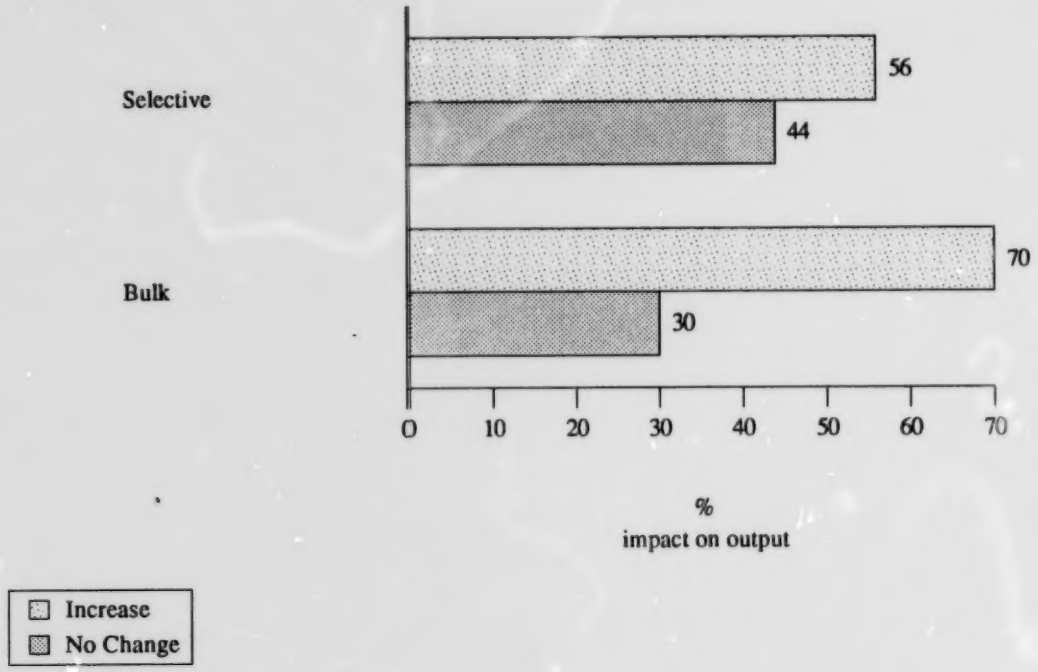
## Chart 17. Impact of the introduction of technologies on product quality by size



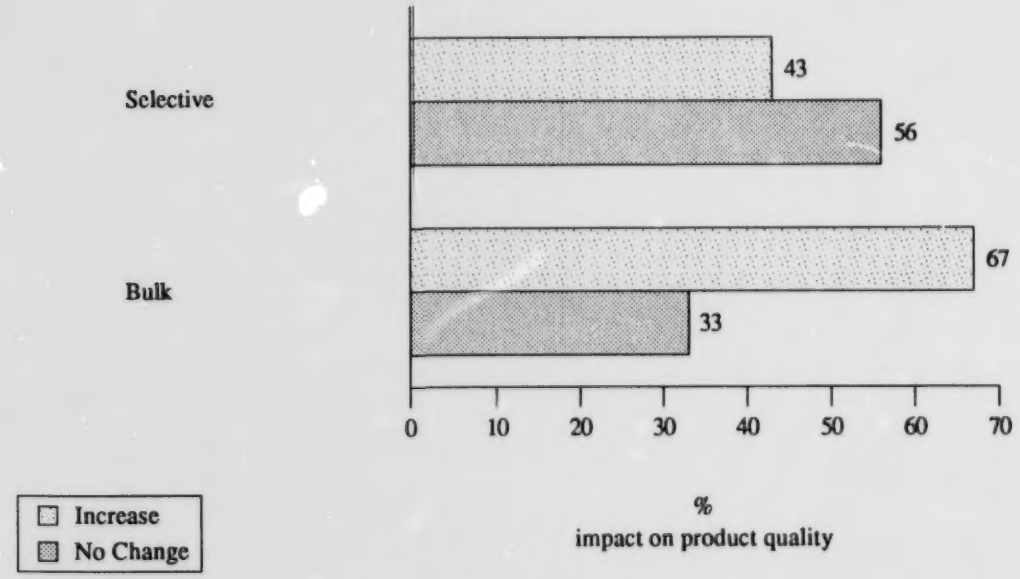

## Chart 18. Impact of the introduction of technologies on costs by size



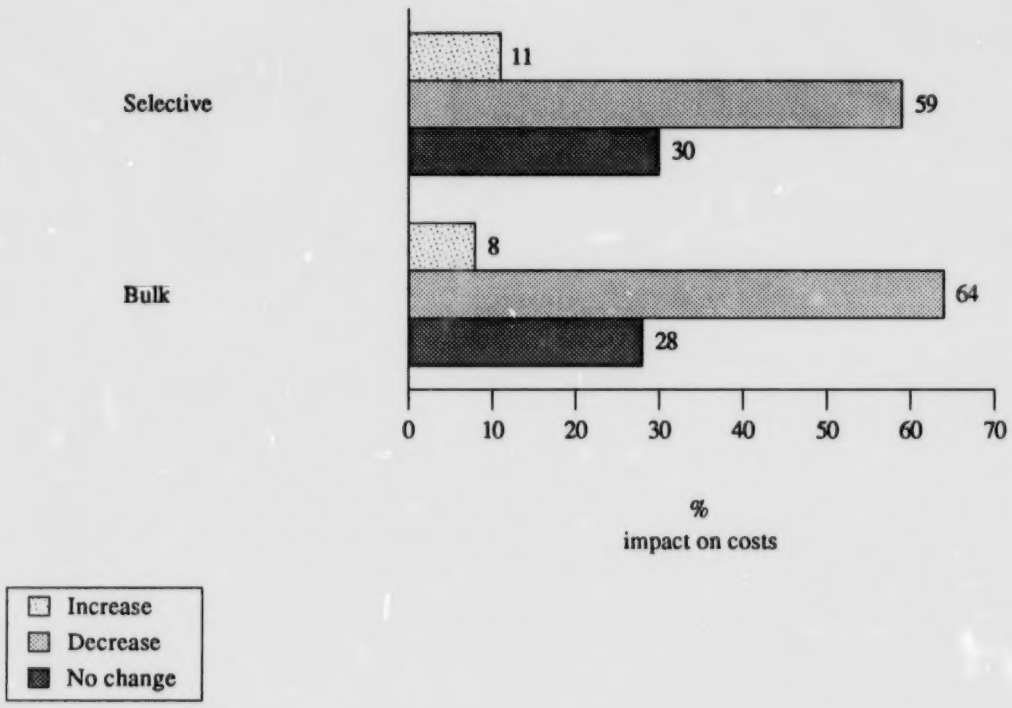
## Chart 19. Impact of the introduction of technologies on output by mining method




## Chart 20. Impact of the introduction of technologies on product quality by mining method



## Chart 21. Impact of the introduction of technologies on costs by mining method



# *Statistical Tables*

**TABLE 1.1 THE USE OF TECHNOLOGY FOR ALL INDUSTRIES (WEIGHTED BY MINES)**

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 47.2 | 26.1 | 76.6 | 14.4 | 2.7 | 5.1 | 47.7 |
| Aut. conveyor - sequential analog | 35.3 | 16.9 | 86.7 | 2.4 | 3.6 | 2.6 | 62.1 |
| - computer control | 26.8 | 30.2 | 85.7 | 1.6 | 6.3 | 8.1 | 65.1 |
| Aut. slurry pumping - stop select | 32.3 | 15.8 | 89.5 | 3.9 | 1.3 | 5.5 | 62.1 |
| - var. speeds | 29.8 | 22.9 | 85.7 | 7.1 | 1.4 | 9.4 | 60.9 |
| Aut. handling equip. - ores | 27.2 | 25.0 | 79.7 | 3.1 | 4.7 | 6.8 | 66.0 |
| - slurries | 26.8 | 23.8 | 82.5 | 6.3 | 1.6 | 6.8 | 66.4 |
| - concentrates | 21.3 | 22.0 | 84.0 | 4.0 | - | 6.4 | 72.3 |
| - reagents | 23.0 | 33.3 | 79.6 | 3.7 | 1.9 | 10.2 | 66.8 |
| Computer controlled vehicle & equip. | 13.2 | 35.5 | 64.5 | 9.7 | 3.2 | 10.6 | 76.2 |
| Comp. based vehicle & equip. maintenance | 29.4 | 33.3 | 66.7 | 18.8 | 1.4 | 11.9 | 58.7 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 34.0 | 6.3 | 67.5 | 8.8 | 1.3 | 1.7 | 64.3 |
| - underground | 17.0 | 17.5 | 70.0 | 12.5 | - | 7.7 | 75.3 |
| Data communication networks - open pit | 9.4 | 22.7 | 77.3 | 4.5 | 4.5 | 3.8 | 86.8 |
| Underground data communication networks | 15.7 | 35.1 | 75.7 | - | 5.4 | 7.7 | 76.6 |
| In plant data networks linking aut. processes | 26.0 | 34.4 | 82.0 | 3.3 | 4.9 | 10.6 | 63.4 |
| CONTROL | | | | | | | |
| Analog controllers | 45.1 | 19.8 | 78.3 | 4.7 | 3.8 | 4.3 | 50.6 |
| Programmable logic controllers (PLC) | 51.1 | 38.3 | 75.8 | 4.2 | 8.3 | 9.8 | 39.1 |
| On-line statistical process control | 15.3 | 38.9 | 80.6 | - | 8.3 | 16.6 | 68.1 |
| Supervisory control & data acquisition | 22.1 | 42.3 | 84.6 | 3.8 | - | 11.5 | 66.4 |
| Int. expert systems for process control | 11.1 | 46.2 | 76.9 | 7.7 | 3.8 | 11.5 | 77.4 |
| Aut. environmental monitoring & control | 25.1 | 27.1 | 74.6 | 8.5 | 5.1 | 8.9 | 66.0 |
| Automated T.V. image analysis | 8.5 | 20.0 | 70.0 | 5.0 | - | 3.8 | 87.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 11.9 | 25.0 | 92.9 | 3.6 | - | 4.7 | 83.4 |
| On-stream analysis (XRF) | 22.1 | 38.5 | 86.5 | - | - | 6.8 | 71.1 |
| On-stream size analysis | 8.9 | 14.3 | 57.1 | 14.3 | 4.8 | 6.8 | 84.3 |
| Flow density measurement | 41.7 | 22.4 | 81.6 | 5.1 | 1.0 | 8.1 | 50.2 |
| Inventory measurement | 23.4 | 20.0 | 72.7 | 10.9 | 3.6 | 6.8 | 69.8 |

**TABLE 1.2 THE USE OF TECHNOLOGY FOR ALL INDUSTRIES (WEIGHTED BY EMPLOYEES)**

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 77.0 | 32.8 | 68.8 | 25.6 | 2.4 | 2.2 | 20.8 |
| Aut. conveyor - sequential analog | 59.1 | 16.6 | 92.1 | 1.1 | 1.5 | 1.4 | 39.4 |
| - computer control | 54.1 | 37.3 | 93.0 | 0.8 | 3.6 | 7.4 | 38.5 |
| Aut. slurry pumping - stop select | 52.0 | 27.8 | 93.0 | 2.0 | 1.5 | 6.1 | 42.0 |
| - var. speeds | 58.3 | 35.5 | 91.0 | 4.7 | 1.2 | 6.9 | 34.8 |
| Aut. handling equip. - ores | 59.1 | 30.7 | 76.7 | 5.2 | 6.9 | 6.5 | 34.4 |
| - slurries | 58.3 | 25.5 | 76.6 | 10.9 | 4.5 | 5.8 | 35.9 |
| - concentrates | 47.9 | 29.1 | 81.0 | 7.0 | - | 6.1 | 46.0 |
| - reagents | 52.0 | 32.6 | 86.1 | 2.4 | 1.5 | 11.1 | 36.9 |
| Computer controlled vehicle & equipment | 34.0 | 38.5 | 47.5 | 7.0 | 21.5 | 10.4 | 55.6 |
| Comp. based vehicle & equip. maintenance | 51.0 | 33.3 | 62.3 | 11.4 | 14.3 | 9.7 | 39.3 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 50.4 | 3.6 | 70.8 | 7.8 | 0.3 | 0.3 | 49.2 |
| - underground | 39.5 | 29.6 | 81.0 | 4.4 | - | 4.7 | 55.9 |
| Data communication networks - open pit | 24.0 | 19.6 | 93.8 | 1.8 | 2.9 | 4.6 | 71.3 |
| Underground data communication networks | 37.0 | 63.6 | 65.7 | - | 21.6 | 8.9 | 54.2 |
| In plant data networks linking aut. proc. | 56.8 | 37.9 | 73.3 | 2.1 | 15.0 | 14.1 | 29.1 |
| CONTROL | | | | | | | |
| Analog controllers | 71.7 | 21.0 | 84.3 | 4.0 | 3.1 | 2.1 | 26.1 |
| Programmable logic controllers (PLC) | 77.5 | 49.5 | 85.7 | 2.1 | 4.8 | 8.8 | 13.7 |
| On-line statistical process control | 30.0 | 47.6 | 94.2 | - | 3.0 | 27.6 | 42.4 |
| Supervisory control & data acquisition | 51.1 | 49.2 | 92.0 | 3.8 | - | 9.9 | 39.0 |
| Int. expert systems for process control | 30.6 | 49.0 | 75.0 | 11.9 | 1.4 | 19.6 | 49.7 |
| Aut. environmental monitoring & control | 56.0 | 36.2 | 82.4 | 7.1 | 6.3 | 9.2 | 34.9 |
| Automated T.V. image analysis | 19.1 | 17.5 | 68.6 | 7.7 | - | 3.1 | 77.9 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 24.6 | 18.7 | 91.0 | 6.0 | - | 2.7 | 72.8 |
| On-stream analysis (XRF) | 51.3 | 34.5 | 89.5 | - | - | 8.5 | 40.2 |
| On-stream size analysis | 28.0 | 8.3 | 65.3 | 17.2 | 0.6 | 12.2 | 59.8 |
| Flow density measurement | 74.2 | 22.0 | 84.7 | 6.4 | 0.6 | 6.4 | 19.4 |
| Inventory measurement | 41.6 | 25.4 | 70.5 | 15.4 | 2.9 | 10.2 | 48.1 |

TABLE 2.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)

| Technologies | Currently use | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gold | Copper- & Copp. Zinc | Nickel-Copper | Silver-Lead-Zinc | Uranium | Iron | Other Metal | Asbestos | Gypsum | Potash | Salt | Other Non-Metal | Coal |
| AUTOMATED MATERIAL HANDLING | | | | | | | | | | | | | |
| Automatic bin level measurement | 39.2 | 54.5 | 80.0 | 43.8 | 66.7 | 100.0 | 25.0 | 75.0 | 33.3 | 90.9 | 54.5 | 30.3 | 47.4 |
| Aut. conveyor - sequential analog | 27.0 | 54.5 | 60.0 | 31.3 | 44.4 | 62.5 | 25.0 | 50.0 | 26.7 | 72.7 | 27.3 | 27.3 | 31.6 |
| - computer control | 24.3 | 45.5 | 60.0 | 25.0 | 11.1 | 75.0 | - | 50.0 | 13.3 | 90.9 | 18.2 | 3.0 | 21.1 |
| Aut. slurry pumping - stop select | 31.1 | 40.9 | 60.0 | 37.5 | 77.8 | 75.0 | 12.5 | 25.0 | 6.7 | 72.7 | 18.2 | 6.1 | 36.8 |
| - var. speeds | 29.7 | 59.1 | 80.0 | 37.5 | 44.4 | 75.0 | 12.5 | - | 6.7 | 54.5 | 9.1 | 3.0 | 26.3 |
| Aut. handling equip. - ores | 23.0 | 59.1 | 80.0 | 25.0 | 44.4 | 75.0 | 12.5 | 75.0 | - | 63.6 | 18.2 | 3.0 | 10.5 |
| - slurries | 23.0 | 68.2 | 80.0 | 37.5 | 55.6 | 62.5 | 12.5 | - | - | 54.5 | - | - | 21.1 |
| - concentrates | 16.2 | 45.5 | 80.0 | 37.5 | 22.2 | 50.0 | - | 50.0 | - | 63.6 | 9.1 | 3.0 | 5.3 |
| - reagents | 23.0 | 59.1 | 80.0 | 25.0 | 55.6 | 37.5 | 12.5 | - | - | 63.6 | - | - | - |
| Computer controlled vehicle & equipment | 8.1 | 31.8 | 40.0 | 6.3 | 22.2 | 37.5 | - | 50.0 | - | 9.1 | 9.1 | 9.1 | 15.8 |
| Comp. based vehicle & equip. maintenance | 28.4 | 59.1 | 40.0 | 31.3 | 44.4 | 37.5 | 12.5 | - | 6.7 | 45.5 | 18.2 | 12.1 | 42.1 |
| COMMUNICATIONS & NETWORKS | | | | | | | | | | | | | |
| Radio based voice networks - open pit | 24.3 | 63.6 | 40.0 | 18.8 | 22.2 | 62.5 | 25.0 | 100.0 | 46.7 | 27.3 | - | 21.2 | 68.4 |
| - underground | 17.6 | 36.4 | 80.0 | 18.8 | 33.3 | - | - | 25.0 | - | 36.4 | 9.1 | 3.0 | 10.5 |
| Data communication networks - open pit | 2.7 | 18.2 | 20.0 | 6.3 | - | 50.0 | - | 25.0 | 6.7 | 18.2 | - | 3.0 | 26.3 |
| Underground data communication networks | 18.9 | 36.4 | 80.0 | 18.8 | 33.3 | - | 12.5 | - | - | 27.3 | - | 3.0 | - |
| In plant data networks linking aut. processes | 21.6 | 45.5 | 80.0 | 18.8 | 66.7 | 62.5 | 12.5 | 25.0 | - | 63.6 | 27.3 | 6.1 | 15.8 |
| CONTROL | | | | | | | | | | | | | |
| Analog controllers | 39.2 | 59.1 | 80.0 | 50.0 | 55.6 | 87.5 | 25.0 | 75.0 | 20.0 | 81.8 | 54.5 | 24.2 | 47.4 |
| Programmable logic controllers (PLC) | 44.6 | 59.1 | 80.0 | 50.0 | 55.6 | 87.5 | 37.5 | 75.0 | 33.3 | 100.0 | 90.9 | 21.2 | 57.9 |
| On-line statistical process control | 12.2 | 18.2 | 60.0 | 25.0 | 22.2 | 37.5 | - | - | - | 54.5 | - | 9.1 | 10.5 |
| Supervisory control & data acquisition | 14.9 | 40.9 | 80.0 | 43.8 | 33.3 | 50.0 | 12.5 | 25.0 | - | 72.7 | 18.2 | 3.0 | 5.3 |
| Int. expert systems for process control | 6.8 | 13.6 | 60.0 | 18.8 | 44.4 | 37.5 | - | 50.0 | - | - | - | 6.1 | 5.3 |
| Aut. environmental monitoring & control | 21.6 | 31.8 | 80.0 | 43.8 | 55.6 | 37.5 | 12.5 | 75.0 | - | 45.5 | 27.3 | - | 26.3 |
| Automated T.V. image analysis | 8.1 | 22.7 | 20.0 | - | - | 37.5 | - | - | - | 27.3 | - | 6.1 | - |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | | | | | | | |
| Near-stream analysis | 13.5 | 9.1 | 20.0 | 6.3 | 22.2 | 62.5 | - | - | 13.3 | 36.4 | - | 3.0 | - |
| On-stream analysis (XRF) | 8.1 | 72.7 | 80.0 | 56.3 | 33.3 | 37.5 | 37.5 | 25.0 | - | 45.5 | 9.1 | - | 5.3 |
| On-stream size analysis | 5.4 | 36.4 | 40.0 | 18.8 | 22.2 | 12.5 | - | - | - | 9.1 | - | - | - |
| Flow density measurement | 43.2 | 68.2 | 80.0 | 50.0 | 55.6 | 100.0 | 25.0 | 50.0 | 6.7 | 81.8 | 27.3 | 9.1 | 31.6 |
| Inventory measurement | 20.3 | 45.5 | 60.0 | 25.0 | 44.4 | 25.0 | 12.5 | 25.0 | 20.0 | 45.5 | 18.2 | 6.1 | 15.8 |

TABLE 2.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

| Technologies | Currently use | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Gold | Copper- & Copp. Zinc | Nickel-Copper | Silver-Lead-Zinc | Uranium | Iron | Other Metal | Asbestos | Gypsum | Potash | Salt | Other Non-Metal | Coal |
| AUTOMATED MATERIAL HANDLING | | | | | | | | | | | | | |
| Automated bin level measurement | 61.2 | 63.7 | 99.8 | 80.0 | 86.0 | 100.0 | 35.5 | 87.9 | 26.6 | 96.8 | 36.6 | 36.8 | 86.9 |
| Aut. conveyor - sequential analog | 37.4 | 56.5 | 75.5 | 75.3 | 72.7 | 74.0 | 35.5 | 74.1 | 21.3 | 78.9 | 24.9 | 31.7 | 55.8 |
| - computer control | 44.8 | 62.6 | 90.4 | 45.7 | 9.0 | 56.8 | - | 74.1 | 14.2 | 95.8 | 15.1 | 7.4 | 36.6 |
| Aut. slurry pumping - stop select | 53.0 | 37.7 | 52.6 | 44.9 | 86.9 | 56.3 | 24.5 | 50.3 | 11.8 | 71.4 | 5.5 | 6.7 | 74.5 |
| - var speeds | 46.0 | 66.5 | 99.8 | 67.7 | 71.2 | 84.5 | 24.5 | - | 11.8 | 49.5 | 3.5 | 4.5 | 37.4 |
| Aut. handling equip. - ores | 39.7 | 63.1 | 99.8 | 27.5 | 74.9 | 85.0 | 24.5 | 87.9 | - | 76.0 | 19.8 | 7.4 | 28.1 |
| - slurries | 39.6 | 66.5 | 99.8 | 77.9 | 72.1 | 78.2 | 24.5 | - | - | 72.8 | - | - | 37.4 |
| - concentrates | 23.9 | 51.4 | 99.8 | 44.9 | 41.1 | 41.3 | - | 74.1 | - | 77.0 | 13.1 | 3.5 | 22.8 |
| - reagents | 35.2 | 78.8 | 99.8 | 63.9 | 75.7 | 30.8 | 24.5 | - | - | 77.0 | - | - | - |
| Computer controlled vehicle & equipment | 15.3 | 34.6 | 66.1 | 11.4 | 47.5 | 61.1 | - | 37.6 | - | 25.3 | 6.7 | 8.8 | 30.3 |
| Comp. based vehicle & equip. maintenance | 47.2 | 75.8 | 56.6 | 57.1 | 45.4 | 34.7 | 24.5 | - | 2.4 | 59.7 | 44.3 | 21.7 | 53.2 |
| COMMUNICATIONS & NETWORKS | | | | | | | | | | | | | |
| Radio based voice networks - open pit | 28.8 | 61.6 | 66.1 | 18.3 | 6.9 | 77.7 | 59.2 | 100.0 | 64.8 | 32.7 | - | 26.8 | 88.0 |
| - underground | 32.1 | 56.8 | 90.6 | 37.6 | 34.3 | - | - | 50.3 | - | 29.2 | 6.7 | 4.5 | 7.7 |
| Data communication networks - open pit | 2.4 | 14.5 | 47.2 | 5.7 | - | 71.1 | - | 50.3 | 8.3 | 7.4 | - | 0.4 | 55.9 |
| Underground data communication networks | 32.7 | 38.5 | 90.6 | 60.4 | 49.8 | - | 17.1 | - | - | 42.4 | - | 9.5 | - |
| In plant data networks linking aut. processes | 39.5 | 60.7 | 99.8 | 46.8 | 89.6 | 49.7 | 24.5 | 23.8 | - | 77.0 | 49.6 | 8.5 | 29.5 |
| CONTROL | | | | | | | | | | | | | |
| Analog controllers | 57.0 | 66.7 | 99.8 | 85.9 | 85.4 | 63.1 | 35.5 | 87.9 | 26.4 | 79.8 | 71.2 | 29.8 | 59.3 |
| Programmable logic controllers (PLC) | 65.2 | 67.9 | 99.8 | 62.1 | 61.4 | 82.5 | 70.1 | 87.9 | 37.0 | 100.0 | 97.3 | 31.9 | 89.8 |
| On-line statistical process control | 21.5 | 9.3 | 75.5 | 35.3 | 23.8 | 50.3 | - | - | - | 66.9 | - | 9.5 | 9.4 |
| Supervisory control & data acquisition | 24.4 | 57.9 | 99.8 | 83.6 | 70.1 | 43.5 | 24.5 | 23.8 | - | 80.2 | 42.8 | 7.4 | 0.7 |
| Int. expert systems for process control | 10.5 | 24.4 | 75.5 | 46.8 | 35.1 | 54.1 | - | 74.1 | - | - | - | 6.1 | 0.6 |
| Aut. environmental monitoring & control | 31.1 | 43.0 | 99.8 | 82.2 | 85.4 | 33.0 | 24.5 | 87.9 | - | 64.6 | 56.5 | - | 39.6 |
| Automated T.V. image analysis | 11.9 | 23.9 | 47.2 | - | - | 34.7 | - | - | - | 46.1 | - | 6.7 | - |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | | | | | | | |
| Near-stream analysis | 23.6 | 6.2 | 47.2 | 6.8 | 31.6 | 78.4 | - | - | 8.0 | 52.0 | - | 4.5 | - |
| On-stream analysis (XRF) | 14.9 | 88.9 | 99.8 | 88.3 | 32.5 | 19.7 | 76.2 | 23.8 | - | 56.8 | 40.8 | - | 16.7 |
| On-stream size analysis | 11.6 | 43.8 | 71.5 | 43.4 | 3.5 | 36.9 | - | - | - | 25.3 | - | - | - |
| Flow density measurement | 60.6 | 83.3 | 99.8 | 89.0 | 81.7 | 100.0 | 35.5 | 37.6 | 8.3 | 79.7 | 45.5 | 9.2 | 57.8 |
| Inventory measurement | 28.0 | 43.2 | 75.5 | 48.0 | 72.7 | 17.3 | 11.0 | 23.8 | 31.9 | 55.6 | 53.9 | 9.8 | 10.5 |

**TABLE 3.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Gold Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 39.2 | 24.1 | 82.8 | 6.9 | 3.4 | 6.8 | 54.1 |
| Aut. conveyor - sequential analog | 27.0 | 15.0 | 85.0 | - | 10.0 | 5.4 | 67.6 |
| - computer control | 24.3 | 16.7 | 72.2 | - | 11.1 | 4.1 | 71.6 |
| Aut. slurry pumping - stop select | 31.1 | 8.7 | 82.6 | 4.3 | - | 5.4 | 63.5 |
| - var. speeds | 29.7 | 18.2 | 77.3 | 4.5 | 4.5 | 10.8 | 59.5 |
| Aut. handling equip. - ores | 23.0 | 17.6 | 88.2 | - | - | 6.8 | 70.3 |
| - slurries | 23.0 | 11.8 | 94.1 | - | - | 5.4 | 71.6 |
| - concentrates | 16.2 | 8.3 | 91.7 | - | - | 6.8 | 77.0 |
| - reagents | 23.0 | 23.5 | 82.4 | - | - | 9.5 | 67.6 |
| Computer controlled vehicle & equipment | 8.1 | 33.3 | 66.7 | 16.7 | - | 12.2 | 79.7 |
| Comp. based vehicle & equip. maintenance | 28.4 | 23.8 | 47.6 | 33.3 | - | 10.8 | 60.8 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 24.3 | 5.6 | 50.0 | 16.7 | - | 1.4 | 74.3 |
| - underground | 17.6 | 15.4 | 53.8 | 23.1 | - | 10.8 | 71.6 |
| Data communication networks - open pit | 2.7 | - | 50.0 | - | - | 2.7 | 94.6 |
| Underground data communication networks | 18.9 | 28.6 | 78.6 | - | 7.1 | 10.8 | 70.3 |
| In plant data networks linking aut. processes | 21.6 | 31.3 | 75.0 | 6.3 | - | 5.4 | 73.0 |
| CONTROL | | | | | | | |
| Analog controllers | 39.2 | 20.7 | 65.5 | 10.3 | 6.9 | 5.4 | 55.4 |
| Programmable logic controllers (PLC) | 44.6 | 27.3 | 60.6 | 15.2 | 6.1 | 12.2 | 43.2 |
| On-line statistical process control | 12.2 | 33.3 | 88.9 | - | - | 9.5 | 78.4 |
| Supervisory control & data acquisition | 14.9 | 36.4 | 81.8 | - | - | 12.2 | 73.0 |
| Int. expert systems for process control | 6.8 | 20.0 | 80.0 | 20.0 | - | 6.8 | 86.5 |
| Aut. environmental monitoring & control | 21.6 | 25.0 | 68.8 | 18.8 | - | 9.5 | 68.9 |
| Automated T.V. image analysis | 8.1 | - | 83.3 | - | - | 4.1 | 87.8 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 13.5 | 20.0 | 90.0 | - | - | 6.8 | 79.7 |
| On-stream analysis (XRF) | 8.1 | 33.3 | 83.3 | - | - | 8.1 | 83.8 |
| On-stream size analysis | 5.4 | - | 75.0 | - | - | 6.8 | 87.8 |
| Flow density measurement | 43.2 | 15.6 | 75.0 | 9.4 | - | 6.8 | 50.0 |
| Inventory measurement | 20.3 | 13.3 | 93.3 | - | - | 5.4 | 74.3 |

**TABLE 3.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)**

Gold Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 61.2 | 31.2 | 84.4 | 4.9 | 2.8 | 3.6 | 35.2 |
| Aut. conveyor - sequential analog | 37.4 | 10.1 | 83.6 | - | 5.8 | 5.4 | 57.2 |
| - computer control | 44.8 | 13.8 | 75.5 | - | 9.9 | 3.8 | 51.4 |
| Aut. slurry pumping - stop select | 53.0 | 4.2 | 82.8 | 3.8 | - | 3.4 | 43.6 |
| - var. speeds | 46.0 | 11.1 | 76.0 | 0.8 | 7.7 | 10.6 | 43.3 |
| Aut. handling equip. - ores | 39.7 | 15.5 | 84.2 | - | - | 5.9 | 54.4 |
| - slurries | 39.6 | 6.1 | 94.2 | - | - | 5.2 | 55.2 |
| - concentrates | 23.9 | 6.4 | 83.4 | - | - | 6.7 | 69.4 |
| - reagents | 35.2 | 13.6 | 81.5 | - | - | 11.8 | 53.0 |
| Computer controlled vehicle & equipment | 15.3 | 23.8 | 63.7 | 10.4 | - | 9.8 | 74.9 |
| Comp. based vehicle & equip. maintenance | 47.2 | 17.6 | 49.3 | 33.6 | - | 8.7 | 44.1 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 28.8 | 0.4 | 66.3 | 6.8 | - | - | 71.2 |
| - underground | 32.1 | 8.3 | 52.2 | 22.7 | - | 12.6 | 55.3 |
| Data communication networks - open pit | 2.4 | - | 44.4 | - | - | 2.2 | 95.3 |
| Underground data communication networks | 32.7 | 39.8 | 74.8 | - | 10.8 | 15.5 | 51.8 |
| In plant data networks linking aut. proc. | 39.5 | 31.1 | 72.1 | 4.1 | - | 3.4 | 57.1 |
| CONTROL | | | | | | | |
| Analog controllers | 57.0 | 18.5 | 58.2 | 12.9 | 9.3 | 7.9 | 35.1 |
| Programmable logic controllers (PLC) | 65.2 | 22.1 | 66.4 | 13.0 | 3.1 | 15.4 | 19.4 |
| On-line statistical process control | 21.5 | 39.3 | 98.9 | - | - | 8.4 | 70.1 |
| Supervisory control & data acquisition | 24.4 | 40.7 | 82.6 | - | - | 11.6 | 64.0 |
| Int. expert systems for process control | 10.5 | 12.1 | 92.4 | 7.6 | - | 6.9 | 82.6 |
| Aut. environmental monitoring & control | 31.1 | 28.8 | 76.8 | 11.8 | - | 11.9 | 57.0 |
| Automated T.V. image analysis | 11.9 | - | 66.7 | - | - | 3.6 | 84.5 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 23.6 | 10.1 | 83.2 | - | - | 4.9 | 71.4 |
| On-stream analysis (XRF) | 14.9 | 8.0 | 73.3 | - | - | 6.1 | 79.0 |
| On-stream size analysis | 11.6 | - | 65.7 | - | - | 8.7 | 79.7 |
| Flow density measurement | 60.6 | 15.4 | 73.4 | 12.2 | - | 8.5 | 30.9 |
| Inventory measurement | 28.0 | 13.3 | 95.2 | - | - | 2.8 | 69.2 |

**TABLE 4.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Copper and Copper-Zinc Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 54.5 | 25.0 | 91.7 | 8.3 | - | 4.5 | 40.9 |
| Aut. conveyor - sequential analog | 54.5 | 8.3 | 91.7 | - | - | - | 45.5 |
| - computer control | 45.5 | 40.0 | 100.0 | - | - | - | 54.5 |
| Aut. slurry pumping - stop select | 40.9 | - | 88.9 | - | - | 9.1 | 50.0 |
| - var. speeds | 59.1 | 30.8 | 92.3 | - | - | - | 40.9 |
| Aut. handling equip. - ores | 59.1 | 23.1 | 61.5 | - | 7.7 | 4.5 | 36.4 |
| - slurries | 68.2 | 20.0 | 73.3 | - | - | 4.5 | 27.3 |
| - concentrates | 45.5 | 10.0 | 70.0 | - | - | 9.1 | 45.5 |
| - reagents | 59.1 | 23.1 | 61.5 | 7.7 | 7.7 | 9.1 | 31.8 |
| Computer controlled vehicle & equipment | 31.8 | 42.9 | 57.1 | - | - | 9.1 | 59.1 |
| Comp. based vehicle & equip. maintenance | 59.1 | 38.5 | 69.2 | - | - | - | 40.9 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 63.6 | - | 64.3 | 7.1 | - | - | 36.4 |
| - underground | 36.4 | 12.5 | 62.5 | - | - | 4.5 | 59.1 |
| Data communication networks - open pit | 18.2 | 25.0 | 75.0 | 25.0 | - | 4.5 | 77.3 |
| Underground data communication networks | 36.4 | - | 62.5 | - | - | 4.5 | 59.1 |
| In plant data networks linking aut. processes | 45.5 | 30.0 | 90.0 | - | - | 18.2 | 36.4 |
| CONTROL | | | | | | | |
| Analog controllers | 59.1 | 15.4 | 61.5 | - | - | - | 40.9 |
| Programmable logic controllers (PLC) | 59.1 | 46.2 | 76.9 | - | - | - | 40.9 |
| On-line statistical process control | 18.2 | 25.0 | 50.0 | - | - | 9.1 | 72.7 |
| Supervisory control & data acquisition | 40.9 | 33.3 | 77.8 | - | - | 4.5 | 54.5 |
| Int. expert systems for process control | 13.6 | 33.3 | 33.3 | 33.3 | - | 31.8 | 54.5 |
| Aut. environmental monitoring & control | 31.8 | 28.6 | 85.7 | - | - | 18.2 | 50.0 |
| Automated T.V. image analysis | 22.7 | - | 20.0 | - | - | 4.5 | 72.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 9.1 | - | 100.0 | - | - | - | 90.9 |
| On-stream analysis (XRF) | 72.7 | 25.0 | 68.8 | - | - | - | 27.3 |
| On-stream size analysis | 36.4 | 12.5 | 25.0 | 25.0 | - | 9.1 | 54.5 |
| Flow density measurement | 68.2 | 20.0 | 73.3 | 6.7 | - | 4.5 | 27.3 |
| Inventory measurement | 45.5 | 10.0 | 40.0 | 20.0 | - | 4.5 | 50.0 |

TABLE 4.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Copper and Copper-Zinc Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 63.7 | 43.3 | 67.8 | 32.2 | - | 3.5 | 32.8 |
| Aut. conveyor - sequential analog | 56.5 | 5.0 | 96.7 | - | - | - | 43.5 |
| - computer control | 62.6 | 50.1 | 100.0 | - | - | - | 37.4 |
| Aut. slurry pumping - stop select | 37.7 | - | 92.5 | - | - | 24.0 | 38.3 |
| - var. speeds | 66.5 | 51.4 | 95.8 | - | - | - | 33.5 |
| Aut. handling equip. - ores | 63.1 | 21.6 | 54.2 | - | 8.8 | 3.5 | 33.4 |
| - slurries | 66.5 | 20.5 | 64.9 | - | - | 3.5 | 30.0 |
| - concentrates | 51.4 | 8.3 | 60.1 | - | - | 6.3 | 42.3 |
| - reagents | 78.8 | 17.3 | 62.0 | 6.0 | 6.0 | 6.3 | 14.9 |
| Computer controlled vehicle & equipment | 34.6 | 59.4 | 40.6 | - | - | 6.3 | 59.1 |
| Comp. based vehicle & equip. maintenance | 75.8 | 37.0 | 67.0 | - | - | - | 24.2 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 61.6 | - | 46.4 | 17.2 | - | - | 38.4 |
| - underground | 56.8 | 36.2 | 63.8 | - | - | 3.5 | 39.8 |
| Data communication networks - open pit | 14.5 | 32.5 | 82.7 | 17.3 | - | 10.6 | 74.9 |
| Underground data communication networks | 38.5 | - | 46.7 | - | - | 20.5 | 40.9 |
| In plant data networks linking aut. proc. | 60.7 | 45.7 | 95.4 | - | - | 22.4 | 16.8 |
| CONTROL | | | | | | | |
| Analog controllers | 66.7 | 9.1 | 68.2 | - | - | - | 33.3 |
| Programmable logic controllers (PLC) | 67.9 | 55.8 | 76.6 | - | - | - | 32.1 |
| On-line statistical process control | 9.3 | 26.9 | 52.8 | - | - | 23.4 | 67.3 |
| Supervisory control & data acquisition | 57.9 | 47.9 | 89.8 | - | - | 2.8 | 39.3 |
| Int. expert systems for process control | 24.4 | 84.1 | 1.9 | 84.1 | - | 43.4 | 32.2 |
| Aut. environmental monitoring & control | 43.0 | 51.4 | 93.4 | - | - | 13.8 | 43.2 |
| Automated T.V. image analysis | 23.9 | - | 7.7 | - | - | 10.6 | 65.5 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 6.2 | - | 100.0 | - | - | - | 93.8 |
| On-stream analysis (XRF) | 88.9 | 27.9 | 70.9 | - | - | - | 11.1 |
| On-stream size analysis | 43.8 | 10.7 | 11.8 | 34.9 | - | 23.0 | 33.1 |
| Flow density measurement | 83.3 | 10.4 | 72.3 | 3.0 | - | 2.8 | 13.9 |
| Inventory measurement | 43.2 | 4.3 | 22.2 | 23.8 | - | 20.5 | 36.3 |

**TABLE 5.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Nickel-Copper Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 80.0 | 50.0 | 75.0 | 25.0 | - | - | 20.0 |
| Aut. conveyor - sequential analog | 60.0 | - | 100.0 | - | - | - | 40.0 |
| - computer control | 60.0 | 33.3 | 100.0 | - | - | 20.0 | 20.0 |
| Aut. slurry pumping - stop select | 60.0 | 100.0 | 100.0 | - | - | - | 40.0 |
| - var. speeds | 80.0 | 50.0 | 100.0 | - | - | - | 20.0 |
| Aut. handling equip. - ores | 80.0 | 75.0 | 75.0 | 25.0 | - | - | 20.0 |
| - slurries | 80.0 | 50.0 | 75.0 | 25.0 | - | - | 20.0 |
| - concentrates | 80.0 | 50.0 | 75.0 | 25.0 | - | - | 20.0 |
| - reagents | 80.0 | 50.0 | 100.0 | - | - | - | 20.0 |
| Computer controlled vehicle & equipment | 40.0 | 50.0 | - | - | 50.0 | 20.0 | 40.0 |
| Comp. based vehicle & equip. maintenance | 40.0 | 50.0 | 50.0 | - | 50.0 | - | 60.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 40.0 | - | 50.0 | - | - | - | 60.0 |
| - underground | 80.0 | 50.0 | 100.0 | - | - | - | 20.0 |
| Data communication networks - open pit | 20.0 | - | 100.0 | - | - | - | 80.0 |
| Underground data communication networks | 80.0 | 75.0 | 75.0 | - | 25.0 | - | 20.0 |
| In plant data networks linking aut. processes | 80.0 | 50.0 | 50.0 | - | 25.0 | - | 20.0 |
| CONTROL | | | | | | | |
| Analog controllers | 80.0 | 50.0 | 100.0 | - | - | - | 20.0 |
| Programmable logic controllers (PLC) | 80.0 | 50.0 | 100.0 | - | - | - | 20.0 |
| On-line statistical process control | 60.0 | 66.7 | 100.0 | - | - | 20.0 | 20.0 |
| Supervisory control & data acquisition | 80.0 | 50.0 | 100.0 | - | - | - | 20.0 |
| Int. expert systems for process control | 60.0 | 66.7 | 66.7 | - | - | 20.0 | 20.0 |
| Aut. environmental monitoring & control | 80.0 | 50.0 | 75.0 | - | 25.0 | - | 20.0 |
| Automated T.V. image analysis | 20.0 | - | 100.0 | - | - | - | 80.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 20.0 | - | 100.0 | - | - | - | 80.0 |
| On-stream analysis (XRF) | 80.0 | 50.0 | 100.0 | - | - | - | 20.0 |
| On-stream size analysis | 40.0 | - | 100.0 | - | - | 20.0 | 40.0 |
| Flow density measurement | 80.0 | 25.0 | 75.0 | 25.0 | - | - | 20.0 |
| Inventory measurement | 60.0 | 33.3 | 66.7 | 33.3 | - | 20.0 | 20.0 |

**TABLE 5.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)**

Nickel-Copper Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 99.8 | 33.8 | 81.1 | 18.9 | - | - | 0.2 |
| Aut. conveyor - sequential analog | 75.5 | - | 100.0 | - | - | - | 24.5 |
| - computer control | 90.4 | 26.9 | 100.0 | - | - | 9.4 | 0.2 |
| Aut. slurry pumping - stop select | 52.6 | 100.0 | 100.0 | - | - | - | 47.4 |
| - var. speeds | 99.8 | 33.8 | 100.0 | - | - | - | 0.2 |
| Aut. handling equip. - ores | 99.8 | 52.7 | 81.1 | 18.9 | - | - | 0.2 |
| - slurries | 99.8 | 28.4 | 81.1 | 18.9 | - | - | 0.2 |
| - concentrates | 99.8 | 28.4 | 81.1 | 18.9 | - | - | 0.2 |
| - reagents | 99.8 | 28.4 | 100.0 | - | - | - | 0.2 |
| Computer controlled vehicle & equipment | 66.1 | 28.6 | - | - | 71.4 | 24.3 | 9.6 |
| Comp. based vehicle & equip. maintenance | 56.6 | 16.7 | 16.7 | - | 83.3 | - | 43.4 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 66.1 | - | 71.4 | - | - | - | 33.9 |
| - underground | 90.6 | 47.7 | 100.0 | - | - | - | 9.4 |
| Data communication networks - open pit | 47.2 | - | 100.0 | - | - | - | 52.8 |
| Underground data communication networks | 90.6 | 99.8 | 47.9 | - | 52.1 | - | 9.4 |
| In plant data networks linking aut. proc. | 99.8 | 28.4 | 33.8 | - | 47.3 | - | 0.2 |
| CONTROL | | | | | | | |
| Analog controllers | 99.8 | 33.8 | 100.0 | - | - | - | 0.2 |
| Programmable logic controllers (PLC) | 99.8 | 28.4 | 100.0 | - | - | - | 0.2 |
| On-line statistical process control | 75.5 | 37.5 | 100.0 | - | - | 24.3 | 0.2 |
| Supervisory control & data acquisition | 99.8 | 28.4 | 100.0 | - | - | - | 0.2 |
| Int. expert systems for process control | 75.5 | 37.5 | 75.0 | - | - | 24.3 | 0.2 |
| Aut. environmental monitoring & control | 99.8 | 33.8 | 81.1 | - | 18.9 | - | 0.2 |
| Automated T.V. image analysis | 47.2 | - | 100.0 | - | - | - | 52.8 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 47.2 | - | 100.0 | - | - | - | 52.8 |
| On-stream analysis (XRF) | 99.8 | 28.4 | 100.0 | - | - | - | 0.2 |
| On-stream size analysis | 71.5 | - | 100.0 | - | - | 18.9 | 9.6 |
| Flow density measurement | 99.8 | 9.5 | 81.1 | 18.9 | - | - | 0.2 |
| Inventory measurement | 75.5 | 12.5 | 75.0 | 25.0 | - | 24.3 | 0.2 |

**TABLE 6.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Silver-Lead-Zinc Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 43.8 | 28.6 | 71.4 | 28.6 | - | 12.5 | 43.8 |
| Aut. conveyor - sequential analog | 31.3 | 40.0 | 80.0 | 20.0 | - | 6.3 | 62.5 |
| - computer control | 25.0 | 50.0 | 75.0 | 25.0 | - | 12.5 | 62.5 |
| Aut. slurry pumping - stop select | 37.5 | 16.7 | 83.3 | 16.7 | - | 6.3 | 56.3 |
| - var. speeds | 37.5 | 33.3 | 83.3 | 16.7 | - | 6.3 | 56.3 |
| Aut. handling equip. - ores | 25.0 | - | 75.0 | - | - | 25.0 | 50.0 |
| - slurries | 37.5 | 33.3 | 66.7 | 33.3 | - | 6.3 | 56.3 |
| - concentrates | 37.5 | 16.7 | 66.7 | 16.7 | - | 6.3 | 56.3 |
| - reagents | 25.0 | 100.0 | 50.0 | 25.0 | - | 25.0 | 50.0 |
| Computer controlled vehicle & equipment | 6.3 | - | - | - | - | 12.5 | 81.3 |
| Comp. based vehicle & equip. maintenance | 31.3 | 40.0 | 60.0 | 40.0 | - | 18.8 | 50.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 18.8 | - | 66.7 | - | - | - | 81.3 |
| - underground | 18.8 | - | 66.7 | - | - | 6.3 | 75.0 |
| Data communication networks - open pit | 6.3 | - | 100.0 | - | - | - | 93.8 |
| Underground data communication networks | 18.8 | 33.3 | 100.0 | - | - | - | 81.3 |
| In plant data networks linking aut. processes | 18.8 | 66.7 | 66.7 | - | 33.3 | 12.5 | 68.8 |
| CONTROL | | | | | | | |
| Analog controllers | 50.0 | 12.5 | 87.5 | - | 12.5 | 6.3 | 43.8 |
| Programmable logic controllers (PLC) | 50.0 | 25.0 | 87.5 | - | 12.5 | 12.5 | 37.5 |
| On-line statistical process control | 25.0 | 50.0 | 75.0 | - | 25.0 | 18.8 | 56.3 |
| Supervisory control & data acquisition | 43.8 | 57.1 | 85.7 | - | - | 6.3 | 50.0 |
| Int. expert systems for process control | 18.8 | 66.7 | 66.7 | - | 33.3 | 12.5 | 68.8 |
| Aut. environmental monitoring & control | 43.8 | 28.6 | 57.1 | - | 14.3 | - | 56.3 |
| Automated T.V. image analysis | - | - | - | - | - | 6.3 | 93.8 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 6.3 | - | 100.0 | - | - | - | 93.8 |
| On-stream analysis (XRF) | 56.3 | 44.4 | 88.9 | - | - | 6.3 | 37.5 |
| On-stream size analysis | 18.8 | - | 66.7 | 33.3 | - | - | 81.3 |
| Flow density measurement | 50.0 | 37.5 | 75.0 | - | 12.5 | 6.3 | 43.8 |
| Inventory measurement | 25.0 | 50.0 | 75.0 | - | 25.0 | 6.3 | 68.8 |

**TABLE 6.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)**

Silver-Lead-Zinc Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 80.0 | 51.3 | 48.7 | 51.3 | - | 8.3 | 11.7 |
| Aut. conveyor - sequential analog | 75.3 | 54.5 | 90.9 | 9.1 | - | 5.7 | 19.0 |
| - computer control | 45.7 | 89.9 | 85.0 | 15.0 | - | 17.1 | 37.2 |
| Aut. slurry pumping - stop select | 44.9 | 15.2 | 84.8 | 15.2 | - | 1.0 | 54.1 |
| - var. speeds | 67.7 | 60.6 | 89.9 | 10.1 | - | 11.4 | 20.9 |
| Aut. handling equip. - ores | 27.5 | - | 29.5 | - | - | 58.2 | 14.3 |
| - slurries | 77.9 | 33.7 | 86.8 | 13.2 | - | 1.2 | 20.9 |
| - concentrates | 44.9 | 15.2 | 41.6 | 15.2 | - | 34.2 | 20.9 |
| - reagents | 63.9 | 100.0 | 83.9 | 10.7 | - | 18.7 | 17.4 |
| Computer controlled vehicle & equipment | 11.4 | - | - | - | - | 9.1 | 79.5 |
| Comp. based vehicle & equip. maintenance | 57.1 | 71.8 | 81.9 | 18.1 | - | 27.7 | 15.1 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 18.3 | - | 37.7 | - | - | - | 81.7 |
| - underground | 37.6 | - | 69.7 | - | - | 1.2 | 61.2 |
| Data communication networks - open pit | 5.7 | - | 100.0 | - | - | - | 94.3 |
| Underground data communication networks | 60.4 | 56.6 | 100.0 | - | - | - | 39.6 |
| In plant data networks linking aut. proc. | 46.8 | 87.8 | 85.4 | - | 14.6 | 30.8 | 22.5 |
| CONTROL | | | | | | | |
| Analog controllers | 85.9 | 8.0 | 92.0 | - | 8.0 | 1.2 | 12.9 |
| Programmable logic controllers (PLC) | 62.1 | 66.2 | 89.0 | - | 11.0 | 30.8 | 7.2 |
| On-line statistical process control | 35.3 | 74.2 | 80.6 | - | 19.4 | 40.3 | 24.3 |
| Supervisory control & data acquisition | 83.6 | 85.9 | 96.9 | - | - | 1.2 | 15.2 |
| Int. expert systems for process control | 46.8 | 87.8 | 85.4 | - | 14.6 | 6.1 | 47.1 |
| Aut. environmental monitoring & control | 82.2 | 49.9 | 76.3 | - | 8.3 | - | 17.8 |
| Automated T.V. image analysis | - | - | - | - | - | 5.7 | 94.3 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 6.8 | - | 100.0 | - | - | - | 93.2 |
| On-stream analysis (XRF) | 88.3 | 45.6 | 96.0 | - | - | 4.6 | 7.2 |
| On-stream size analysis | 43.4 | - | 21.2 | 78.8 | - | - | 56.6 |
| Flow density measurement | 89.0 | 58.9 | 87.2 | - | 7.7 | 1 2 | 9.8 |
| Inventory measurement | 48.0 | 85.6 | 85.7 | - | 14.3 | 1.2 | 50.8 |

**TABLE 7.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Uranium Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 66.7 | 16.7 | 33.3 | 33.3 | 16.7 | - | 33.3 |
| Aut. conveyor - sequential analog | 44.4 | 25.0 | 100.0 | - | - | - | 55.6 |
| - computer control | 11.1 | - | 100.0 | - | - | - | 88.9 |
| Aut. slurry pumping - stop select | 77.8 | 28.6 | 100.0 | - | - | - | 22.2 |
| - var. speeds | 44.4 | 25.0 | 100.0 | - | - | 11.1 | 44.4 |
| Aut. handling equip. - ores | 44.4 | 25.0 | 75.0 | - | 25.0 | - | 55.6 |
| - slurries | 55.6 | 40.0 | 80.0 | - | 20.0 | - | 44.4 |
| - concentrates | 22.2 | 50.0 | 100.0 | - | - | - | 77.8 |
| - reagents | 55.6 | 40.0 | 100.0 | - | - | - | 44.4 |
| Computer controlled vehicle & equipment | 22.2 | 50.0 | 50.0 | 50.0 | - | 11.1 | 66.7 |
| Comp. based vehicle & equip. maintenance | 44.4 | - | 75.0 | 25.0 | - | 11.1 | 44.4 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 22.2 | - | 50.0 | 50.0 | - | - | 77.8 |
| - underground | 33.3 | 33.3 | 66.7 | 33.3 | - | 11.1 | 55.6 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 33.3 | 66.7 | 66.7 | - | - | - | 66.7 |
| In plant data networks linking aut. processes | 66.7 | 16.7 | 83.3 | 16.7 | - | - | 33.3 |
| CONTROL | | | | | | | |
| Analog controllers | 55.6 | - | 80.0 | 20.0 | - | - | 44.4 |
| Programmable logic controllers (PLC) | 55.6 | 40.0 | 80.0 | - | - | 11.1 | 33.3 |
| On-line statistical process control | 22.2 | - | 100.0 | - | - | - | 77.8 |
| Supervisory control & data acquisition | 33.3 | 33.3 | 66.7 | 33.3 | - | 11.1 | 55.6 |
| Int. expert systems for process control | 44.4 | 25.0 | 100.0 | - | - | - | 55.6 |
| Aut. environmental monitoring & control | 55.6 | 20.0 | 60.0 | 20.0 | 20.0 | 11.1 | 33.3 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 22.2 | - | 100.0 | - | - | - | 77.8 |
| On-stream analysis (XRF) | 33.3 | 33.3 | 100.0 | - | - | - | 66.7 |
| On-stream size analysis | 22.2 | 50.0 | 50.0 | - | 50.0 | - | 77.8 |
| Flow density measurement | 55.6 | 20.0 | 100.0 | - | - | 11.1 | 33.3 |
| Inventory measurement | 44.4 | 25.0 | 100.0 | - | - | - | 55.6 |

## TABLE 7.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Uranium Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 86.0 | 44.8 | 35.0 | 47.8 | 12.2 | - | 14.0 |
| Aut. conveyor - sequential analog | 72.7 | 52.9 | 100.0 | - | - | - | 27.3 |
| - computer control | 9.0 | - | 100.0 | - | - | - | 91.0 |
| Aut. slurry pumping - stop select | 86.9 | 45.3 | 100.0 | - | - | - | 13.1 |
| - var. speeds | 71.2 | 54.0 | 100.0 | - | - | 0.9 | 27.9 |
| Aut. handling equip. - ores | 74.9 | 51.4 | 48.6 | - | 51.4 | - | 25.1 |
| - slurries | 72.1 | 54.6 | 46.6 | - | 53.4 | - | 27.9 |
| - concentrates | 41.1 | 93.6 | 100.0 | - | - | - | 58.9 |
| - reagents | 75.7 | 51.9 | 100.0 | - | - | - | 24.3 |
| Computer controlled vehicle & equipment | 47.5 | 81.1 | 81.1 | 18.9 | - | 0.9 | 51.7 |
| Comp. based vehicle & equip. maintenance | 45.4 | - | 53.4 | 46.6 | - | 0.9 | 53.8 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 6.9 | - | 38.1 | 61.9 | - | - | 93.1 |
| - underground | 34.3 | 30.6 | 92.3 | 7.7 | - | 0.9 | 64.9 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 49.8 | 79.0 | 98.3 | - | - | - | 50.2 |
| In plant data networks linking aut. proc. | 89.6 | 42.9 | 85.9 | 14.1 | - | - | 10.4 |
| CONTROL | | | | | | | |
| Analog controllers | 85.4 | - | 85.2 | 14.8 | - | - | 14.6 |
| Programmable logic controllers (PLC) | 61.4 | 64.0 | 98.6 | - | - | 12.6 | 26.0 |
| On-line statistical process control | 23.8 | - | 100.0 | - | - | - | 76.2 |
| Supervisory control & data acquisition | 70.1 | 54.9 | 69.8 | 30.2 | - | 12.6 | 17.3 |
| Int. expert systems for process control | 35.1 | 2.4 | 100.0 | - | - | - | 64.9 |
| Aut. environmental monitoring & control | 85.4 | 45.1 | 51.8 | 45.1 | 3.1 | 0.9 | 13.8 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 31.6 | - | 100.0 | - | - | - | 68.4 |
| On-stream analysis (XRF) | 32.5 | 2.6 | 100.0 | - | - | - | 67.5 |
| On-stream size analysis | 3.5 | 24.5 | 24.5 | - | 75.5 | - | 96.5 |
| Flow density measurement | 81.7 | 47.1 | 100.0 | - | - | 12.6 | 5.7 |
| Inventory measurement | 72.7 | 52.9 | 100.0 | - | - | - | 27.3 |

**TABLE 8.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Iron Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 100.0 | 37.5 | 62.5 | 25.0 | 12.5 | - | - |
| Aut. conveyor - sequential analog | 62.5 | 20.0 | 100.0 | - | - | - | 37.5 |
| - computer control | 75.0 | 66.7 | 83.3 | - | 16.7 | - | 25.0 |
| Aut. slurry pumping - stop select | 75.0 | 16.7 | 83.3 | - | 16.7 | - | 25.0 |
| - var. speeds | 75.0 | 33.3 | 100.0 | - | - | - | 25.0 |
| Aut. handling equip. - ores | 75.0 | 50.0 | 100.0 | - | - | - | 25.0 |
| - slurries | 62.5 | 40.0 | 80.0 | 20.0 | - | - | 37.5 |
| - concentrates | 50.0 | 50.0 | 100.0 | - | - | - | 50.0 |
| - reagents | 37.5 | 33.3 | 100.0 | - | - | 12.5 | 50.0 |
| Computer controlled vehicle & equipment | 37.5 | 66.7 | 100.0 | - | - | - | 62.5 |
| Comp. based vehicle & equip. maintenance | 37.5 | 100.0 | 100.0 | - | - | 25.0 | 37.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 62.5 | 20.0 | 80.0 | 20.0 | - | - | 37.5 |
| - underground | - | - | - | - | - | - | 100.0 |
| Data communication networks - open pit | 50.0 | 50.0 | 100.0 | - | - | - | 50.0 |
| Underground data communication networks | - | - | - | - | - | - | 100.0 |
| In plant data networks linking aut. processes | 62.5 | 60.0 | 80.0 | - | 20.0 | 25.0 | 12.5 |
| CONTROL | | | | | | | |
| Analog controllers | 87.5 | 57.1 | 85.7 | - | 14.3 | - | 12.5 |
| Programmable logic controllers (PLC) | 87.5 | 71.4 | 71.4 | - | 28.6 | 12.5 | - |
| On-line statistical process control | 37.5 | 66.7 | 100.0 | - | - | 50.0 | 12.5 |
| Supervisory control & data acquisition | 50.0 | 100.0 | 100.0 | - | - | 12.5 | 37.5 |
| Int. expert systems for process control | 37.5 | 100.0 | 100.0 | - | - | 12.5 | 50.0 |
| Aut. environmental monitoring & control | 37.5 | 66.7 | 66.7 | 33.3 | - | 12.5 | 50.0 |
| Automated T.V. image analysis | 37.5 | 66.7 | 100.0 | - | - | - | 62.5 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 62.5 | 60.0 | 100.0 | - | - | 12.5 | 25.0 |
| On-stream analysis (XRF) | 37.5 | 33.3 | 100.0 | - | - | 25.0 | 37.5 |
| On-stream size analysis | 12.5 | - | 100.0 | - | - | 25.0 | 62.5 |
| Flow density measurement | 100.0 | 37.5 | 100.0 | - | - | - | - |
| Inventory measurement | 25.0 | 100.0 | 50.0 | - | 50.0 | 12.5 | 62.5 |

**TABLE 8.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)**

Iron Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 100.0 | 24.1 | 43.9 | 45.6 | 10.5 | - | - |
| Aut. conveyor - sequential analog | 74.0 | 9.2 | 100.0 | - | - | - | 26.0 |
| - computer control | 56.8 | 57.7 | 84.6 | - | 15.4 | - | 43.2 |
| Aut. slurry pumping - stop select | 56.3 | 12.1 | 81.4 | - | 18.6 | - | 43.7 |
| - var. speeds | 84.5 | 51.7 | 100.0 | - | - | - | 15.5 |
| Aut. handling equip. - ores | 85.0 | 28.3 | 100.0 | - | - | - | 15.0 |
| - slurries | 78.2 | 22.1 | 52.9 | 47.1 | - | - | 21.8 |
| - concentrates | 41.3 | 41.8 | 100.0 | - | - | - | 58.7 |
| - reagents | 30.8 | 22.0 | 100.0 | - | - | 8.7 | 60.4 |
| Computer controlled vehicle & equipment | 61.1 | 39.7 | 100.0 | - | - | - | 38.9 |
| Comp. based vehicle & equip. maintenance | 34.7 | 100.0 | 100.0 | - | - | 45.6 | 19.7 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 77.7 | 22.5 | 77.5 | 22.5 | - | - | 22.3 |
| - underground | - | - | - | - | - | - | 100.0 |
| Data communication networks - open pit | 71.1 | 39.3 | 100.0 | - | - | - | 28.9 |
| Underground data communication networks | - | - | - | - | - | - | 100.0 |
| In plant data networks linking aut. proc. | 49.7 | 52.3 | 78.9 | - | 21.1 | 43.7 | 6.6 |
| CONTROL | | | | | | | |
| Analog controllers | 63.1 | 65.8 | 83.4 | - | 16.6 | - | 36.9 |
| Programmable logic controllers (PLC) | 82.5 | 84.4 | 76.7 | - | 23.3 | 17.5 | - |
| On-line statistical process control | 50.3 | 86.9 | 100.0 | - | - | 43.5 | 6.3 |
| Supervisory control & data acquisition | 43.5 | 100.0 | 100.0 | - | - | 6.8 | 49.7 |
| Int. expert systems for process control | 54.1 | 100.0 | 100.0 | - | - | 17.5 | 28.4 |
| Aut. environmental monitoring & control | 33.0 | 73.5 | 73.5 | 26.5 | - | 36.9 | 30.2 |
| Automated T.V. image analysis | 34.7 | 69.8 | 100.0 | - | - | - | 65.3 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 78.4 | 44.3 | 100.0 | - | - | 8.7 | 12.9 |
| On-stream analysis (XRF) | 19.7 | 34.5 | 100.0 | - | - | 27.9 | 52.4 |
| On-stream size analysis | 36.9 | - | 100.0 | - | - | 24.3 | 38.9 |
| Flow density measurement | 100.0 | 34.7 | 100.0 | - | - | - | - |
| Inventory measurement | 17.3 | 100.0 | 39.3 | - | 60.7 | 17.5 | 65.3 |

**TABLE 9.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Other Metal Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 25.0 | 50.0 | 50.0 | 50.0 | - | - | 75.0 |
| Aut. conveyor - sequential analog | 25.0 | - | 100.0 | - | - | - | 75.0 |
| - computer control | - | - | - | - | - | 12.5 | 87.5 |
| Aut. slurry pumping - stop select | 12.5 | - | 100.0 | - | - | - | 87.5 |
| - var. speeds | 12.5 | - | 100.0 | - | - | 12.5 | 75.0 |
| Aut. handling equip. - ores | 12.5 | - | 100.0 | - | - | - | 87.5 |
| - slurries | 12.5 | - | 100.0 | - | - | - | 87.5 |
| - concentrates | - | - | - | - | - | 12.5 | 87.5 |
| - reagents | 12.5 | - | 100.0 | - | - | - | 87.5 |
| Computer controlled vehicle & equipment | - | - | - | - | - | - | 100.0 |
| Comp. based vehicle & equip. maintenance | 12.5 | - | 100.0 | - | - | - | 87.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 25.0 | - | 100.0 | - | - | - | 75.0 |
| - underground | - | - | - | - | - | 25.0 | 75.0 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 12.5 | - | - | - | - | - | 87.5 |
| In plant data networks linking aut. processes | 12.5 | - | 100.0 | - | - | 12.5 | 75.0 |
| CONTROL | | | | | | | |
| Analog controllers | 25.0 | - | 100.0 | - | - | - | 75.0 |
| Programmable logic controllers (PLC) | 37.5 | 33.3 | 100.0 | - | - | - | 62.5 |
| On-line statistical process control | - | - | - | - | - | 12.5 | 87.5 |
| Supervisory control & data acquisition | 12.5 | - | 100.0 | - | - | - | 87.5 |
| Int. expert systems for process control | - | - | - | - | - | 12.5 | 87.5 |
| Aut. environmental monitoring & control | 12.5 | - | 100.0 | - | - | 12.5 | 75.0 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 37.5 | 66.7 | 100.0 | - | - | - | 62.5 |
| On-stream size analysis | - | - | - | - | - | - | 100.0 |
| Flow density measurement | 25.0 | 100.0 | 100.0 | - | - | 12.5 | 62.5 |
| Inventory measurement | 12.5 | - | 100.0 | - | - | - | 87.5 |

## TABLE 9.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Other Metal Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 35.5 | 30.9 | 30.9 | 69.1 | - | - | 64.5 |
| Aut. conveyor - sequential analog | 35.5 | - | 100.0 | - | - | - | 64.5 |
| - computer control | - | - | - | - | - | 24.5 | 75.5 |
| Aut. slurry pumping - stop select | 24.5 | - | 100.0 | - | - | - | 75.5 |
| - var. speeds | 24.5 | - | 100.0 | - | - | 11.0 | 64.5 |
| Aut. handling equip. - ores | 24.5 | - | 100.0 | - | - | - | 75.5 |
| - slurries | 24.5 | - | 100.0 | - | - | - | 75.5 |
| - concentrates | - | - | - | - | - | 24.5 | 75.5 |
| - reagents | 24.5 | - | 100.0 | - | - | - | 75.5 |
| Computer controlled vehicle & equipment | - | - | - | - | - | - | 100.0 |
| Comp. based vehicle & equip. maintenance | 24.5 | - | 100.0 | - | - | - | 75.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 59.2 | - | 100.0 | - | - | - | 40.8 |
| - underground | - | - | - | - | - | 28.0 | 72.0 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 17.1 | - | - | - | - | - | 82.9 |
| In plant data networks linking aut. proc. | 24.5 | - | 100.0 | - | - | 11.0 | 64.5 |
| CONTROL | | | | | | | |
| Analog controllers | 35.5 | - | 100.0 | - | - | - | 64.5 |
| Programmable logic controllers (PLC) | 70.1 | 15.6 | 100.0 | - | - | - | 29.9 |
| On-line statistical process control | - | - | - | - | - | 11.0 | 89.0 |
| Supervisory control & data acquisition | 24.5 | - | 100.0 | - | - | - | 75.5 |
| Int. expert systems for process control | - | - | - | - | - | 24.5 | 75.5 |
| Aut. environmental monitoring & control | 24.5 | - | 100.0 | - | - | 11.0 | 64.5 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 76.2 | 54.5 | 100.0 | - | - | - | 23.8 |
| On-stream size analysis | - | - | - | - | - | - | 100.0 |
| Flow density measurement | 35.5 | 100.0 | 100.0 | - | - | 17.1 | 47.5 |
| Inventory measurement | 11.0 | - | 100.0 | - | - | - | 89.0 |

**TABLE 10.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Asbestos Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 75.0 | - | 100.0 | - | - | - | 25.0 |
| Aut. conveyor - sequential analog | 50.0 | 50.0 | 100.0 | - | - | - | 50.0 |
| - computer control | 50.0 | 50.0 | 100.0 | - | - | - | 50.0 |
| Aut. slurry pumping - stop select | 25.0 | - | 100.0 | - | - | 25.0 | 50.0 |
| - var. speeds | - | - | - | - | - | 25.0 | 75.0 |
| Aut. handling equip. - ores | 75.0 | - | 100.0 | - | - | - | 25.0 |
| - slurries | - | - | - | - | - | 25.0 | 75.0 |
| - concentrates | 50.0 | 50.0 | 100.0 | - | - | - | 50.0 |
| - reagents | - | - | - | - | - | - | 100.0 |
| Computer controlled vehicle & equipment | 50.0 | - | 100.0 | - | - | 25.0 | 25.0 |
| Comp. based vehicle & equip. maintenance | - | - | - | - | - | 25.0 | 75.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 100.0 | - | 75.0 | - | - | - | - |
| - underground | 25.0 | - | 100.0 | - | - | - | 75.0 |
| Data communication networks - open pit | 25.0 | - | 100.0 | - | - | - | 75.0 |
| Underground data communication networks | - | - | - | - | - | - | 100.0 |
| In plant data networks linking aut. processes | 25.0 | - | 100.0 | - | - | - | 75.0 |
| CONTROL | | | | | | | |
| Analog controllers | 75.0 | - | 66.7 | 33.3 | - | - | 25.0 |
| Programmable logic controllers (PLC) | 75.0 | 66.7 | 66.7 | - | - | 25.0 | - |
| On-line statistical process control | - | - | - | - | - | 50.0 | 50.0 |
| Supervisory control & data acquisition | 25.0 | - | 100.0 | - | - | - | 75.0 |
| Int. expert systems for process control | 50.0 | - | 100.0 | - | - | - | 50.0 |
| Aut. environmental monitoring & control | 75.0 | - | 100.0 | - | - | - | 25.0 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 25.0 | - | 100.0 | - | - | - | 75.0 |
| On-stream size analysis | - | - | - | - | - | 25.0 | 75.0 |
| Flow density measurement | 50.0 | - | 100.0 | - | - | 25.0 | 25.0 |
| Inventory measurement | 25.0 | - | - | 100.0 | - | - | 75.0 |

## TABLE 10.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Asbestos Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 87.9 | - | 100.0 | - | - | - | 12.1 |
| Aut. conveyor - sequential analog | 74.1 | 67.9 | 100.0 | - | - | - | 25.9 |
| - computer control | 74.1 | 67.9 | 100.0 | - | - | - | 25.9 |
| Aut. slurry pumping - stop select | 50.3 | - | 100.0 | - | - | 12.1 | 37.6 |
| - var. speeds | - | - | - | - | - | 12.1 | 87.9 |
| Aut. handling equip. - ores | 87.9 | - | 100.0 | - | - | - | 12.1 |
| - slurries | - | - | - | - | - | 12.1 | 87.9 |
| - concentrates | 74.1 | 67.9 | 100.0 | - | - | - | 25.9 |
| - reagents | - | - | - | - | - | - | 100.0 |
| Computer controlled vehicle & equipment | 37.6 | - | 100.0 | - | - | 12.1 | 50.3 |
| Comp. based vehicle & equip. maintenance | - | - | - | - | - | 12.1 | 87.9 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 100.0 | - | 87.9 | - | - | - | - |
| - underground | 50.3 | - | 100.0 | - | - | - | 49.7 |
| Data communication networks - open pit | 50.3 | - | 100.0 | - | - | - | 49.7 |
| Underground data communication networks | - | - | - | - | - | - | 100.0 |
| In plant data networks linking aut. proc. | 23.8 | - | 100.0 | - | - | - | 76.2 |
| CONTROL | | | | | | | |
| Analog controllers | 87.9 | - | 84.3 | 15.7 | - | - | 12.1 |
| Programmable logic controllers (PLC) | 87.9 | 72.9 | 84.3 | - | - | 12.1 | - |
| On-line statistical process control | - | - | - | - | - | 74.1 | 25.9 |
| Supervisory control & data acquisition | 23.8 | - | 100.0 | - | - | - | 76.2 |
| Int. expert systems for process control | 74.1 | - | 100.0 | - | - | - | 25.9 |
| Aut. environmental monitoring & control | 87.9 | - | 100.0 | - | - | - | 12.1 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 23.8 | - | 100.0 | - | - | - | 76.2 |
| On-stream size analysis | - | - | - | - | - | 12.1 | 87.9 |
| Flow density measurement | 37.6 | - | 100.0 | - | - | 12.1 | 50.3 |
| Inventory measurement | 23.8 | - | - | 100.0 | - | - | 76.2 |

**TABLE 11.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Gypsum Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 33.3 | 40.0 | 80.0 | 20.0 | - | 6.7 | 60.0 |
| Aut. conveyor - sequential analog | 26.7 | 25.0 | 75.0 | - | - | 6.7 | 66.7 |
| - computer control | 13.3 | - | 100.0 | - | - | 33.3 | 53.3 |
| Aut. slurry pumping - stop select | 6.7 | - | 100.0 | - | - | 6.7 | 86.7 |
| - var. speeds | 6.7 | - | 100.0 | - | - | 6.7 | 86.7 |
| Aut. handling equip. - ores | - | - | - | - | - | 20.0 | 80.0 |
| - slurries | - | - | - | - | - | 6.7 | 93.3 |
| - concentrates | - | - | - | - | - | 6.7 | 93.3 |
| - reagents | - | - | - | - | - | 6.7 | 93.3 |
| Computer controlled vehicle & equipment | - | - | - | - | - | 26.7 | 73.3 |
| Comp. based vehicle & equip. maintenance | 6.7 | - | 100.0 | - | - | 33.3 | 60.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| 'Radio based voice networks - open pit | 46.7 | 28.6 | 57.1 | 14.3 | 14.3 | 13.3 | 40.0 |
| - underground | - | - | - | - | - | 13.3 | 86.7 |
| Data communication networks - open pit | 6.7 | - | - | - | - | 20.0 | 73.3 |
| Underground data communication networks | - | - | - | - | - | 20.0 | 80.0 |
| In plant data networks linking aut. processes | - | - | - | - | - | 20.0 | 80.0 |
| CONTROL | | | | | | | |
| Analog controllers | 20.0 | 33.3 | 100.0 | - | - | 13.3 | 66.7 |
| Programmable logic controllers (PLC) | 33.3 | 20.0 | 60.0 | - | 20.0 | 26.7 | 40.0 |
| On-line statistical process control | - | - | - | - | - | 26.7 | 73.3 |
| Supervisory control & data acquisition | - | - | - | - | - | 20.0 | 80.0 |
| Int. expert systems for process control | - | - | - | - | - | 26.7 | 73.3 |
| Aut. environmental monitoring & control | - | - | - | - | - | 13.3 | 86.7 |
| Automated T.V. image analysis | - | - | - | - | - | 13.3 | 86.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 13.3 | 50.0 | 100.0 | - | - | 6.7 | 80.0 |
| On-stream analysis (XRF) | - | - | - | - | - | 6.7 | 93.3 |
| On-stream size analysis | - | - | - | - | - | 6.7 | 93.3 |
| Flow density measurement | 6.7 | - | - | - | - | 6.7 | 86.7 |
| Inventory measurement | 20.0 | - | 66.7 | - | - | 26.7 | 53.3 |

## TABLE 11.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Gypsum Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 26.6 | 35.6 | 91.1 | 8.9 | - | 3.1 | 70.3 |
| Aut. conveyor - sequential analog | 21.3 | 26.7 | 82.2 | - | - | 3.1 | 75.7 |
| - computer control | 14.2 | - | 100.0 | - | - | 32.4 | 53.4 |
| Aut. slurry pumping - stop select | 11.8 | - | 100.0 | - | - | 3.1 | 85.1 |
| - var. speeds | 11.8 | - | 100.0 | - | - | 3.1 | 85.1 |
| Aut. handling equip. - ores | - | - | - | - | - | 17.6 | 82.4 |
| - slurries | - | - | - | - | - | 3.1 | 96.9 |
| - concentrates | - | - | - | - | - | 3.1 | 96.9 |
| - reagents | - | - | - | - | - | 3.1 | 96.9 |
| Computer controlled vehicle & equipment | - | - | - | - | - | 29.4 | 70.6 |
| Comp. based vehicle & equip. maintenance | 2.4 | - | 100.0 | - | - | 32.4 | 65.2 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 64.8 | 27.0 | 50.7 | 18.2 | 18.2 | 7.2 | 28.0 |
| - underground | - | - | - | - | - | 11.9 | 88.1 |
| Data communication networks - open pit | 8.3 | - | - | - | - | 20.6 | 71.2 |
| Underground data communication networks | - | - | - | - | - | 14.3 | 85.7 |
| In plant data networks linking aut. proc. | - | - | - | - | - | 11.1 | 88.9 |
| CONTROL | | | | | | | |
| Analog controllers | 26.4 | 21.5 | 100.0 | - | - | 6.9 | 66.8 |
| Programmable logic controllers (PLC) | 37.0 | 15.3 | 53.7 | - | 24.0 | 21.6 | 41.4 |
| On-line statistical process control | - | - | - | - | - | 15.5 | 84.5 |
| Supervisory control & data acquisition | - | - | - | - | - | 11.1 | 88.9 |
| Int. expert systems for process control | - | - | - | - | - | 15.5 | 84.5 |
| Aut. environmental monitoring & control | - | - | - | - | - | 8.7 | 91.3 |
| Automated T.V. image analysis | - | - | - | - | - | 8.7 | 91.3 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 8.0 | 70.6 | 100.0 | - | - | 3.1 | 88.9 |
| On-stream analysis (XRF) | - | - | - | - | - | 3.1 | 96.9 |
| On-stream size analysis | - | - | - | - | - | 3.1 | 96.9 |
| Flow density measurement | 8.3 | - | - | - | - | 3.1 | 88.7 |
| Inventory measurement | 31.9 | - | 74.1 | - | - | 30.5 | 37.6 |

**TABLE 12.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Potash Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 90.9 | 10.0 | 80.0 | 10.0 | - | - | 9.1 |
| Aut. conveyor - sequential analog | 72.7 | - | 100.0 | - | - | - | 27.3 |
| - computer control | 90.9 | 20.0 | 100.0 | - | - | 9.1 | - |
| Aut. slurry pumping - stop select | 72.7 | 12.5 | 100.0 | - | - | - | 27.3 |
| - var. speeds | 54.5 | - | 83.3 | 16.7 | - | 9.1 | 36.4 |
| Aut. handling equip. - ores | 63.6 | 14.3 | 100.0 | - | - | - | 36.4 |
| - slurries | 54.5 | 33.3 | 100.0 | - | - | - | 45.5 |
| - concentrates | 63.6 | 28.6 | 85.7 | - | - | - | 36.4 |
| - reagents | 63.6 | 28.6 | 85.7 | - | - | 9.1 | 27.3 |
| Computer controlled vehicle & equipment | 9.1 | 100.0 | - | 100.0 | - | 27.3 | 63.6 |
| Comp. based vehicle & equip. maintenance | 45.5 | 40.0 | 80.0 | 20.0 | - | 9.1 | 45.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 27.3 | - | 100.0 | - | - | - | 72.7 |
| - underground | 36.4 | - | 75.0 | 25.0 | - | 9.1 | 54.5 |
| Data communication networks - open pit | 18.2 | 50.0 | 100.0 | - | - | - | 81.8 |
| Underground data communication networks | 27.3 | 66.7 | 100.0 | - | - | 18.2 | 54.5 |
| In plant data networks linking aut. processes | 63.6 | 42.9 | 100.0 | - | - | 9.1 | 27.3 |
| CONTROL | | | | | | | |
| Analog controllers | 81.8 | 11.1 | 88.9 | - | - | - | 18.2 |
| Programmable logic controllers (PLC) | 100.0 | 36.4 | 100.0 | - | - | - | - |
| On-line statistical process control | 54.5 | 50.0 | 83.3 | - | 16.7 | 18.2 | 27.3 |
| Supervisory control & data acquisition | 72.7 | 37.5 | 87.5 | 12.5 | - | 9.1 | 18.2 |
| Int. expert systems for process control | - | - | - | - | - | 18.2 | 81.8 |
| Aut. environmental monitoring & control | 45.5 | 40.0 | 100.0 | - | - | 9.1 | 45.5 |
| Automated T.V. image analysis | 27.3 | 33.3 | 66.7 | 33.3 | - | - | 72.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 36.4 | 25.0 | 75.0 | 25.0 | - | - | 63.6 |
| On-stream analysis (XRF) | 45.5 | 40.0 | 100.0 | - | - | - | 54.5 |
| On-stream size analysis | 9.1 | 100.0 | 100.0 | - | - | 9.1 | 81.8 |
| Flow density measurement | 81.8 | 22.2 | 88.9 | - | - | - | 18.2 |
| Inventory measurement | 45.5 | 20.0 | 80.0 | 20.0 | - | 9.1 | 45.5 |

## TABLE 12.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Potash Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 96.8 | 26.1 | 83.3 | 12.4 | - | - | 3.2 |
| Aut. conveyor - sequential analog | 78.9 | - | 100.0 | - | - | - | 21.1 |
| - computer control | 95.8 | 36.4 | 100.0 | - | - | 4.2 | - |
| Aut. slurry pumping - stop select | 71.4 | 13.4 | 100.0 | - | - | - | 28.6 |
| - var. speeds | 49.5 | - | 82.1 | 17.9 | - | 4.2 | 46.3 |
| Aut. handling equip. - ores | 76.0 | 33.2 | 100.0 | - | - | - | 24.0 |
| - slurries | 72.8 | 47.9 | 100.0 | - | - | - | 27.2 |
| - concentrates | 77.0 | 45.2 | 94.5 | - | - | - | 23.0 |
| - reagents | 77.0 | 45.2 | 94.5 | - | - | 8.3 | 14.6 |
| Computer controlled vehicle & equipment | 25.3 | 100.0 | - | 100.0 | - | 26.6 | 48.1 |
| Comp. based vehicle & equip. maintenance | 59.7 | 58.4 | 86.2 | 13.8 | - | 3.2 | 37.1 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 32.7 | - | 100.0 | - | - | - | 67.3 |
| - underground | 29.2 | - | 89.2 | 10.8 | - | 9.6 | 61.2 |
| Data communication networks - open pit | 7.4 | 42.8 | 100.0 | - | - | - | 92.6 |
| Underground data communication networks | 42.4 | 80.6 | 100.0 | - | - | 18.4 | 39.2 |
| In plant data networks linking aut. proc. | 77.0 | 50.7 | 100.0 | - | - | 3.2 | 19.8 |
| CONTROL | | | | | | | |
| Analog controllers | 79.8 | 31.7 | 96.0 | - | - | - | 20.2 |
| Programmable logic controllers (PLC) | 100.0 | 46.4 | 100.0 | - | - | - | - |
| On-line statistical process control | 66.9 | 56.6 | 93.7 | - | 6.3 | 18.5 | 14.6 |
| Supervisory control & data acquisition | 80.2 | 47.4 | 89.0 | 11.0 | - | 3.2 | 16.6 |
| Int. expert systems for process control | - | - | - | - | - | 34.9 | 65.1 |
| Aut. environmental monitoring & control | 64.6 | 53.9 | 100.0 | - | - | 3.2 | 32.2 |
| Automated T.V. image analysis | 46.1 | 54.8 | 45.2 | 54.8 | - | - | 53.9 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 52.0 | 48.5 | 51.5 | 48.5 | - | - | 48.0 |
| On-stream analysis (XRF) | 56.8 | 61.3 | 100.0 | - | - | - | 43.2 |
| On-stream size analysis | 25.3 | 100.0 | 100.0 | - | - | 9.6 | 65.1 |
| Flow density measurement | 79.7 | 43.7 | 96.0 | - | - | - | 20.3 |
| Inventory measurement | 55.6 | 45.5 | 92.4 | 7.6 | - | 9.6 | 34.8 |

**TABLE 13.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Salt Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 54.5 | 16.7 | 66.7 | 16.7 | - | 9.1 | 36.4 |
| Aut. conveyor - sequential analog | 27.3 | 33.3 | 33.3 | 33.3 | 33.3 | - | 72.7 |
| - computer control | 18.2 | 50.0 | 50.0 | - | 50.0 | - | 81.8 |
| Aut. slurry pumping - stop select | 18.2 | - | 100.0 | - | - | 9.1 | 72.7 |
| - var. speeds | 9.1 | - | 100.0 | - | - | 9.1 | 81.8 |
| Aut. handling equip. - ores | 18.2 | 50.0 | - | - | 50.0 | - | 81.8 |
| - slurries | - | - | - | - | - | - | 100.0 |
| - concentrates | 9.1 | - | 100.0 | - | - | - | 90.9 |
| - reagents | - | - | - | - | - | - | 100.0 |
| Computer controlled vehicle & equipment | 9.1 | - | - | - | - | 18.2 | 72.7 |
| Comp. based vehicle & equip. maintenance | 18.2 | 50.0 | 100.0 | - | - | 27.3 | 54.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | - | - | - | - | - | - | 100.0 |
| - underground | 9.1 | 100.0 | 100.0 | - | - | - | 90.9 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | - | - | - | - | - | 18.2 | 81.8 |
| In plant data networks linking aut. processes | 27.3 | - | 66.7 | - | - | 9.1 | 63.6 |
| CONTROL | | | | | | | |
| Analog controllers | 54.5 | 16.7 | 100.0 | - | - | 9.1 | 36.4 |
| Programmable logic controllers (PLC) | 90.9 | 40.0 | 90.0 | - | 10.0 | - | 9.1 |
| On-line statistical process control | - | - | - | - | - | 18.2 | 81.8 |
| Supervisory control & data acquisition | 18.2 | 50.0 | 100.0 | - | - | 18.2 | 63.6 |
| Int. expert systems for process control | - | - | - | - | - | - | 100.0 |
| Aut. environmental monitoring & control | 27.3 | 33.3 | 100.0 | - | - | 9.1 | 63.6 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 9.1 | 100.0 | 100.0 | - | - | - | 90.9 |
| On-stream size analysis | - | - | - | - | - | - | 100.0 |
| Flow density measurement | 27.3 | - | 100.0 | - | - | - | 72.7 |
| Inventory measurement | 18.2 | - | 50.0 | 50.0 | - | - | 81.8 |

## TABLE 13.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Salt Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 36.6 | 35.7 | 39.2 | 35.7 | - | 3.5 | 60.0 |
| Aut. conveyor - sequential analog | 24.9 | 52.5 | 27.0 | 20.5 | 52.5 | - | 75.1 |
| - computer control | 15.1 | 86.5 | 13.5 | - | 86.5 | - | 84.9 |
| Aut. slurry pumping - stop select | 5.5 | - | 100.0 | - | - | 9.2 | 85.3 |
| - var. speeds | 3.5 | - | 100.0 | - | - | 9.2 | 87.4 |
| Aut. handling equip. - ores | 19.8 | 66.0 | - | - | 66.0 | - | 80.2 |
| - slurries | - | - | - | - | - | - | 100.0 |
| - concentrates | 13.1 | - | 100.0 | - | - | - | 86.9 |
| - reagents | - | - | - | - | - | - | 100.0 |
| Computer controlled vehicle & equipment | 6.7 | - | - | - | - | 16.5 | 76.7 |
| Comp. based vehicle & equip. maintenance | 44.3 | 92.2 | 100.0 | - | - | 25.1 | 30.6 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | - | - | - | - | - | - | 100.0 |
| - underground | 6.7 | 100.0 | 100.0 | - | - | - | 93.3 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | - | - | - | - | - | 19.8 | 80.2 |
| In plant data networks linking aut. proc. | 49.6 | - | 86.4 | - | - | 13.1 | 37.4 |
| CONTROL | | | | | | | |
| Analog controllers | 71.2 | 18.3 | 100.0 | - | - | 5.1 | 23.7 |
| Programmable logic controllers (PLC) | 97.3 | 75.7 | 86.6 | - | 13.4 | - | 2.7 |
| On-line statistical process control | - | - | - | - | - | 16.5 | 83.5 |
| Supervisory control & data acquisition | 42.8 | 95.2 | 100.0 | - | - | 16.5 | 40.6 |
| Int. expert systems for process control | - | - | - | - | - | - | 100.0 |
| Aut. environmental monitoring & control | 56.5 | 23.1 | 100.0 | - | - | 5.1 | 38.4 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 40.8 | 100.0 | 100.0 | - | - | - | 59.2 |
| On-stream size analysis | - | - | - | - | - | - | 100.0 |
| Flow density measurement | 45.5 | - | 100.0 | - | - | - | 54.5 |
| Inventory measurement | 53.9 | - | 75.8 | 24.2 | - | - | 46.1 |

**TABLE 14.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Other Non-Metal Mines (except coal)

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 30.3 | 40.0 | 90.0 | - | - | 6.1 | 63.6 |
| Aut. conveyor - sequential analog | 27.3 | 33.3 | 88.9 | - | - | - | 72.7 |
| - computer control | 3.0 | 100.0 | - | - | - | 9.1 | 87.9 |
| Aut. slurry pumping - stop select | 6.1 | 50.0 | 100.0 | - | - | 6.1 | 87.9 |
| - var. speeds | 3.0 | 100.0 | 100.0 | - | - | 9.1 | 87.9 |
| Aut. handling equip. - ores | 3.0 | 100.0 | - | 100.0 | - | 3.0 | 93.9 |
| - slurries | - | - | - | - | - | 9.1 | 90.9 |
| - concentrates | 3.0 | - | 100.0 | - | - | 9.1 | 87.9 |
| - reagents | - | - | - | - | - | 9.1 | 90.9 |
| Computer controlled vehicle & equipment | 9.1 | 33.3 | 100.0 | - | - | - | 90.9 |
| Comp. based vehicle & equip. maintenance | 12.1 | 75.0 | 100.0 | - | - | 9.1 | 78.8 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 21.2 | 14.3 | 85.7 | - | - | 3.0 | 75.8 |
| - underground | 3.0 | - | 100.0 | - | - | - | 97.0 |
| Data communication networks - open pit | 3.0 | - | - | - | - | - | 97.0 |
| Underground data communication networks | 3.0 | 100.0 | 100.0 | - | - | - | 97.0 |
| In plant data networks linking aut. processes | 6.1 | 50.0 | 100.0 | - | - | 9.1 | 84.8 |
| CONTROL | | | | | | | |
| Analog controllers | 24.2 | 12.5 | 75.0 | - | - | 6.1 | 69.7 |
| Programmable logic controllers (PLC) | 21.2 | 42.9 | 71.4 | - | - | 12.1 | 66.7 |
| On-line statistical process control | 9.1 | - | 66.7 | - | - | 12.1 | 78.8 |
| Supervisory control & data acquisition | 3.0 | - | - | - | - | 6.1 | 90.9 |
| Int. expert systems for process control | 6.1 | 100.0 | 100.0 | - | - | 3.0 | 90.9 |
| Aut. environmental monitoring & control | - | - | - | - | - | 3.0 | 97.0 |
| Automated T.V. image analysis | 6.1 | 50.0 | 100.0 | - | - | 6.1 | 87.9 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 3.0 | - | 100.0 | - | - | 6.1 | 90.9 |
| On-stream analysis (XRF) | - | - | - | - | - | 6.1 | 93.9 |
| On-stream size analysis | - | - | - | - | - | 6.1 | 93.9 |
| Flow density measurement | 9.1 | 33.3 | 100.0 | - | - | 15.2 | 75.8 |
| Inventory measurement | 6.1 | 50.0 | 100.0 | - | - | 9.1 | 84.8 |

**TABLE 14.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)**

Other Non-Metal Mines (except coal)

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 36.8 | 49.2 | 94.4 | - | - | 13.2 | 50.0 |
| Aut. conveyor - sequential analog | 31.7 | 33.7 | 76.5 | - | - | - | 68.3 |
| - computer control | 7.4 | 100.0 | - | - | - | 26.3 | 66.3 |
| Aut. slurry pumping - stop select | 6.7 | 67.9 | 100.0 | - | - | 18.0 | 75.3 |
| - var. speeds | 4.5 | 100.0 | 100.0 | - | - | 19.0 | 76.4 |
| Aut. handling equip. - ores | 7.4 | 100.0 | - | 100.0 | - | 4.5 | 88.0 |
| - slurries | - | - | - | - | - | 22.6 | 77.4 |
| - concentrates | 3.5 | - | 100.0 | - | - | 22.6 | 74.0 |
| - reagents | - | - | - | - | - | 22.6 | 77.4 |
| Computer controlled vehicle & equipment | 8.8 | 24.5 | 100.0 | - | - | - | 91.2 |
| Comp. based vehicle & equip. maintenance | 21.7 | 86.6 | 100.0 | - | - | 13.5 | 64.9 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 26.8 | 52.5 | 98.5 | - | - | 12.8 | 60.4 |
| - underground | 4.5 | - | 100.0 | - | - | - | 95.5 |
| Data communication networks - open pit | 0.4 | - | - | - | - | - | 99.6 |
| Underground data communication networks | 9.5 | 100.0 | 100.0 | - | - | - | 90.5 |
| In plant data networks linking aut. proc. | 8.5 | 46.6 | 100.0 | - | - | 17.1 | 74.4 |
| CONTROL | | | | | | | |
| Analog controllers | 29.8 | 13.3 | 68.1 | - | - | 15.0 | 55.3 |
| Programmable logic controllers (PLC) | 31.9 | 42.5 | 70.2 | - | - | 31.5 | 36.6 |
| On-line statistical process control | 9.5 | - | 78.3 | - | - | 19.8 | 70.7 |
| Supervisory control & data acquisition | 7.4 | - | - | - | - | 5.0 | 87.6 |
| Int. expert systems for process control | 6.1 | 100.0 | 100.0 | - | - | 7.4 | 86.4 |
| Aut. environmental monitoring & control | - | - | - | - | - | 14.0 | 86.0 |
| Automated T.V. image analysis | 6.7 | 32.1 | 100.0 | - | - | 5.0 | 88.3 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 4.5 | - | 100.0 | - | - | 4.5 | 91.0 |
| On-stream analysis (XRF) | - | - | - | - | - | 17.5 | 82.5 |
| On-stream size analysis | - | - | - | - | - | 17.5 | 82.5 |
| Flow density measurement | 9.2 | 23.4 | 100.0 | - | - | 30.2 | 60.7 |
| Inventory measurement | 9.8 | 40.7 | 100.0 | - | - | 6.9 | 83.4 |

**TABLE 15.1 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY MINES)**

Coal Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 47.4 | 22.2 | 66.7 | 22.2 | - | - | 52.6 |
| Aut. conveyor - sequential analog | 31.6 | - | 66.7 | - | - | - | 68.4 |
| - computer control | 21.1 | - | 100.0 | - | - | 15.8 | 63.2 |
| Aut. slurry pumping - stop select | 36.8 | 14.3 | 85.7 | 14.3 | - | 5.3 | 57.9 |
| - var. speeds | 26.3 | - | 60.0 | 40.0 | - | 21.1 | 52.6 |
| Aut. handling equip. - ores | 10.5 | - | 100.0 | - | - | 10.5 | 78.9 |
| - slurries | 21.1 | - | 75.0 | - | - | 26.3 | 52.6 |
| - concentrates | 5.3 | - | 100.0 | - | - | 10.5 | 84.2 |
| - reagents | - | - | - | - | - | 26.3 | 73.7 |
| Computer controlled vehicle & equipment | 15.8 | - | 100.0 | - | - | - | 84.2 |
| Comp. based vehicle & equip. maintenance | 42.1 | 12.5 | 62.5 | 25.0 | - | 5.3 | 52.6 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 68.4 | - | 76.9 | - | - | - | 31.6 |
| - underground | 10.5 | - | 100.0 | - | - | 10.5 | 78.9 |
| Data communication networks - open pit | 26.3 | 20.0 | 80.0 | - | 20.0 | 15.8 | 57.9 |
| Underground data communication networks | - | - | - | - | - | 10.5 | 89.5 |
| In plant data networks linking aut. processes | 15.8 | 33.3 | 100.0 | - | - | 21.1 | 63.2 |
| CONTROL | | | | | | | |
| Analog controllers | 47.4 | 22.2 | 88.9 | - | - | - | 52.6 |
| Programmable logic controllers (PLC) | 57.9 | 45.5 | 72.7 | - | 27.3 | 5.3 | 36.8 |
| On-line statistical process control | 10.5 | 50.0 | 50.0 | - | 50.0 | 36.8 | 52.6 |
| Supervisory control & data acquisition | 5.3 | - | 100.0 | - | - | 31.6 | 63.2 |
| Int. expert systems for process control | 5.3 | - | - | - | - | 15.8 | 78.9 |
| Aut. environmental monitoring & control | 26.3 | - | 60.0 | - | - | 10.5 | 63.2 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | 10.5 | 89.5 |
| On-stream analysis (XRF) | 5.3 | 100.0 | 100.0 | - | - | 21.1 | 73.7 |
| On-stream size analysis | - | - | - | - | - | 5.3 | 94.7 |
| Flow density measurement | 31.6 | 16.7 | 83.3 | - | - | 15.8 | 52.6 |
| Inventory measurement | 15.8 | - | 66.7 | - | - | - | 84.2 |

## TABLE 15.2 THE USE OF TECHNOLOGY BY INDUSTRY (WEIGHTED BY EMPLOYEES)

Coal Mines

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 86.9 | 24.7 | 64.5 | 27.5 | - | - | 13.1 |
| Aut. conveyor - sequential analog | 55.8 | - | 64.5 | - | - | - | 44.2 |
| - computer control | 36.6 | - | 100.0 | - | - | 27.9 | 35.5 |
| Aut. slurry pumping - stop select | 74.5 | 22.5 | 97.0 | 3.0 | - | 0.6 | 24.9 |
| - var. speeds | 37.4 | - | 51.9 | 48.1 | - | 26.2 | 36.4 |
| Aut. handling equip. - ores | 28.1 | - | 100.0 | - | - | 7.6 | 64.3 |
| - slurries | 37.4 | - | 94.1 | - | - | 33.2 | 29.4 |
| - concentrates | 22.8 | - | 100.0 | - | - | 7.6 | 69.6 |
| - reagents | - | - | - | - | - | 51.9 | 48.1 |
| Computer controlled vehicle & equipment | 30.3 | - | 100.0 | - | - | - | 69.7 |
| Comp. based vehicle & equip. maintenance | 53.2 | 1.3 | 89.5 | 4.7 | - | 6.1 | 40.7 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 88.0 | - | 87.7 | - | - | - | 12.0 |
| - underground | 7.7 | - | 100.0 | - | - | 4.8 | 87.5 |
| Data communication networks - open pit | 55.9 | 29.9 | 87.2 | - | 12.8 | 22.5 | 21.7 |
| Underground data communication networks | - | - | - | - | - | 4.8 | 95.2 |
| In plant data networks linking aut. proc. | 29.5 | 17.8 | 100.0 | - | - | 32.6 | 37.9 |
| CONTROL | | | | | | | |
| Analog controllers | 59.3 | 20.0 | 99.0 | - | - | - | 40.7 |
| Programmable logic controllers (PLC) | 89.8 | 65.6 | 90.1 | - | 9.9 | 4.2 | 6.0 |
| On-line statistical process control | 9.4 | 76.4 | 76.4 | - | 23.6 | 71.8 | 18.8 |
| Supervisory control & data acquisition | 0.7 | - | 100.0 | - | - | 49.0 | 50.3 |
| Int. expert systems for process control | 0.6 | - | - | - | - | 28.4 | 70.9 |
| Aut. environmental monitoring & control | 39.6 | - | 90.7 | - | - | 8.9 | 51.5 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | 10.0 | 90.0 |
| On-stream analysis (XRF) | 16.7 | 100.0 | 100.0 | - | - | 47.5 | 35.8 |
| On-stream size analysis | - | - | - | - | - | 4.2 | 95.8 |
| Flow density measurement | 57.8 | 8.2 | 91.8 | - | - | 21.5 | 20.7 |
| Inventory measurement | 10.5 | - | 70.8 | - | - | - | 89.5 |

**TABLE 16.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

| Technologies | Currently use | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | | | | | | | | |
| | Nfld. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Yukon | N.T. |
| AUTOMATED MATERIAL HANDLING | | | | | | | | | | | |
| Automatic bin level measurement | 30.0 | 21.4 | 37.5 | 32.8 | 69.8 | 25.0 | 56.0 | 37.5 | 53.8 | x | 62.5 |
| Aut. conveyor - sequential analog | 10.0 | 7.1 | 50.0 | 36.2 | 45.3 | 37.5 | 36.0 | 25.0 | 35.9 | x | 37.5 |
| - computer control | 10.0 | 7.1 | 37.5 | 19.0 | 37.7 | 12.5 | 44.0 | - | 33.3 | x | 25.0 |
| Aut. slurry pumping - stop select | 20.0 | 7.1 | 25.0 | 15.5 | 39.6 | 12.5 | 48.0 | 37.5 | 48.7 | x | 62.5 |
| - var. speeds | 30.0 | 14.3 | 50.0 | 13.8 | 41.5 | 12.5 | 24.0 | 25.0 | 43.6 | x | 62.5 |
| Aut. handling equip. - ores | 20.0 | 7.1 | 25.0 | 15.5 | 45.3 | 37.5 | 28.0 | - | 35.9 | x | 25.0 |
| - slurries | 20.0 | 7.1 | 50.0 | 10.3 | 35.8 | 37.5 | 32.0 | 12.5 | 38.5 | x | 37.5 |
| - concentrates | 10.0 | - | 37.5 | 19.0 | 24.5 | 37.5 | 28.0 | - | 23.1 | x | 25.0 |
| - reagents | - | 7.1 | 37.5 | 15.5 | 34.0 | 37.5 | 32.0 | - | 25.6 | x | 25.0 |
| Computer controlled vehicle & equipment | 10.0 | - | - | 13.8 | 15.1 | 37.5 | 16.0 | 12.5 | 12.8 | x | - |
| Comp. based vehicle & equip. maintenance | 20.0 | 14.3 | 25.0 | 19.0 | 35.8 | 25.0 | 44.0 | 37.5 | 30.8 | x | 37.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | | | | | |
| Radio based voice networks - open pit | 30.0 | 42.9 | 25.0 | 17.2 | 22.6 | 50.0 | 32.0 | 50.0 | 66.7 | x | 37.5 |
| - underground | - | 7.1 | 12.5 | 13.8 | 28.3 | 37.5 | 20.0 | 12.5 | 7.7 | x | 25.0 |
| Data communication networks - open pit | 20.0 | 7.1 | 12.5 | 6.9 | 5.7 | - | 8.0 | 25.0 | 17.9 | x | - |
| Underground data communication networks | 10.0 | - | 25.0 | 17.2 | 24.5 | 37.5 | 16.0 | - | 5.1 | x | 25.0 |
| In plant data networks linking aut. processes | 10.0 | 7.1 | 50.0 | 15.5 | 45.3 | 12.5 | 36.0 | 12.5 | 23.1 | x | 25.0 |
| CONTROL | | | | | | | | | | | |
| Analog controllers | 20.0 | 21.4 | 37.5 | 27.6 | 62.3 | 37.5 | 52.0 | 50.0 | 56.4 | x | 75.0 |
| Programmable logic controllers (PLC) | 30.0 | 28.6 | 62.5 | 36.2 | 69.8 | 25.0 | 60.0 | 62.5 | 56.4 | x | 75.0 |
| On-line statistical process control | 10.0 | - | 25.0 | 6.9 | 24.5 | 12.5 | 28.0 | 12.5 | 12.8 | x | 25.0 |
| Supervisory control & data acquisition | 10.0 | 7.1 | 62.5 | 17.2 | 32.1 | 12.5 | 28.0 | 25.0 | 15.4 | x | 12.5 |
| Int. expert systems for process control | 20.0 | - | 25.0 | 10.3 | 20.8 | 12.5 | 8.0 | - | 5.1 | x | - |
| Aut. environmental monitoring & control | - | 7.1 | 62.5 | 13.8 | 39.6 | 12.5 | 16.0 | 50.0 | 30.8 | x | 25.0 |
| Automated T.V. image analysis | 10.0 | - | 12.5 | 10.3 | 9.4 | 25.0 | 12.0 | - | 2.6 | x | 12.5 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | | | | | |
| Near-stream analysis | 20.0 | - | - | 17.2 | 18.9 | - | 16.0 | - | 5.1 | x | - |
| On-stream analysis (XRF) | - | 7.1 | 50.0 | 20.7 | 26.4 | 37.5 | 24.0 | 12.5 | 25.6 | x | - |
| On-stream size analysis | 10.0 | - | 25.0 | 3.4 | 13.2 | 25.0 | 16.0 | - | 7.7 | x | - |
| Flow density measurement | 30.0 | 14.3 | 37.5 | 22.4 | 54.7 | 62.5 | 52.0 | 50.0 | 48.7 | x | 75.0 |
| Inventory measurement | 10.0 | 14.3 | 37.5 | 17.2 | 34.0 | 50.0 | 28.0 | 25.0 | 15.4 | x | 25.0 |

**TABLE 16.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)**

| Technologies | Currently use | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | % | | | | | | | | | | |
| | Nfld. | N.S. | N.B. | Que. | Ont. | Man. | Sask. | Alta. | B.C. | Yukon | N.T. |
| AUTOMATED MATERIAL HANDLING | | | | | | | | | | | |
| Automatic bin level measurement | 80.2 | 40.7 | 77.0 | 59.5 | 90.0 | 56.1 | 74.2 | 43.4 | 85.9 | x | 67.0 |
| Aut. conveyor - sequential analog | 56.2 | 17.2 | 83.6 | 54.8 | 65.3 | 56.5 | 47.5 | 40.3 | 58.9 | x | 53.9 |
| - computer control | 16.0 | 7.2 | 77.0 | 52.0 | 64.8 | 53.2 | 66.6 | - | 52.7 | x | 45.9 |
| Aut. slurry pumping - stop select | 24.0 | 17.2 | 15.3 | 42.4 | 48.1 | 53.2 | 62.0 | 31.4 | 84.1 | x | 81.7 |
| - var. speeds | 80.2 | 23.3 | 80.8 | 24.6 | 77.5 | 53.2 | 31.6 | 28.3 | 63.8 | x | 75.1 |
| Aut. handling equip. - ores | 72.1 | 17.2 | 27.4 | 42.8 | 71.6 | 95.8 | 58.6 | - | 62.8 | x | 45.9 |
| - slurries | 72.1 | 17.2 | 80.8 | 21.0 | 65.8 | 95.8 | 65.0 | 6.8 | 66.4 | x | 68.6 |
| - concentrates | 16.0 | - | 31.2 | 44.9 | 54.4 | 95.8 | 59.4 | - | 45.9 | x | 25.7 |
| - reagents | - | 17.2 | 77.0 | 27.1 | 74.3 | 95.8 | 60.2 | - | 39.2 | x | 40.8 |
| Computer controlled vehicle & equip. | 56.2 | - | - | 24.9 | 34.5 | 95.8 | 42.4 | 6.8 | 31.8 | x | - |
| Comp. based vehicle & equip. maintenance | 24.0 | 23.3 | 56.3 | 28.5 | 59.4 | 42.6 | 73.8 | 55.7 | 54.5 | x | 56.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | | | | | |
| Radio based voice networks - open pit | 82.5 | 51.4 | 14.9 | 43.9 | 33.5 | 96.2 | 48.8 | 43.3 | 81.0 | x | 24.6 |
| - underground | - | 3.5 | 11.7 | 30.1 | 59.6 | 95.8 | 32.6 | 21.5 | 14.0 | x | 50.5 |
| Data communication networks - open pit | 72.1 | 5.1 | 8.3 | 25.0 | 22.7 | - | 5.5 | 28.3 | 38.1 | x | - |
| Underground data communication networks | 3.4 | - | 61.3 | 22.6 | 52.2 | 95.8 | 40.9 | - | 13.0 | x | 50.5 |
| In plant data networks linking aut. proc. | 16.0 | 17.2 | 85.2 | 34.5 | 81.2 | 53.2 | 50.8 | 46.8 | 47.6 | x | 45.9 |
| CONTROL | | | | | | | | | | | |
| Analog controllers | 24.0 | 39.6 | 65.1 | 56.0 | 87.2 | 56.7 | 60.0 | 73.5 | 81.6 | x | 87.2 |
| Programmable logic controllers (PLC) | 80.2 | 44.7 | 89.0 | 61.0 | 85.8 | 56.1 | 74.5 | 95.9 | 84.1 | x | 87.2 |
| On-line statistical process control | 56.2 | - | 24.0 | 11.3 | 38.9 | 53.2 | 44.0 | 6.8 | 16.2 | x | 50.5 |
| Supervisory control & data acquisition | 16.0 | 17.2 | 89.0 | 36.7 | 70.0 | 53.2 | 45.3 | 48.9 | 34.6 | x | 27.8 |
| Int. expert systems for process control | 72.1 | - | 57.9 | 25.7 | 46.4 | 53.2 | 3.1 | - | 3.8 | x | - |
| Aut. environmental monitoring & control | - | 17.2 | 91.9 | 39.6 | 76.0 | 53.2 | 35.0 | 90.2 | 48.9 | x | 26.1 |
| Automated T.V. image analysis | 16.0 | - | 15.7 | 19.2 | 23.6 | 42.6 | 40.6 | - | 1.6 | x | 10.1 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | | | | | |
| Near-stream analysis | 72.1 | - | - | 27.4 | 36.9 | - | 38.9 | - | 2.0 | x | - |
| On-stream analysis (XRF) | - | 17.2 | 73.3 | 33.9 | 62.6 | 95.8 | 51.7 | 46.8 | 50.1 | x | - |
| On-stream size analysis | 56.2 | - | 57.9 | 9.2 | 36.4 | 42.6 | 37.1 | - | 18.4 | x | - |
| Flow density measurement | 80.2 | 22.2 | 69.5 | 37.2 | 86.4 | 99.1 | 80.6 | 78.2 | 77.1 | x | 87.2 |
| Inventory measurement | 16.0 | 18.1 | 67.9 | 25.9 | 50.4 | 98.7 | 53.7 | 53.6 | 20.4 | x | 26.1 |

**TABLE 17.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

Newfoundland

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 30.0 | 33.3 | 33.3 | 33.3 | 33.3 | - | 70.0 |
| Aut. conveyor - sequential analog | 10.0 | - | 100.0 | - | - | - | 90.0 |
| - computer control | 10.0 | 100.0 | 100.0 | - | - | - | 90.0 |
| Aut. slurry pumping - stop select | 20.0 | - | 50.0 | - | 50.0 | 10.0 | 70.0 |
| - var. speeds | 30.0 | 33.3 | 100.0 | - | - | 10.0 | 60.0 |
| Aut. handling equip. - ores | 20.0 | 50.0 | 100.0 | - | - | - | 80.0 |
| - slurries | 20.0 | 50.0 | 50.0 | 50.0 | - | 10.0 | 70.0 |
| - concentrates | 10.0 | 100.0 | 100.0 | - | - | - | 90.0 |
| - reagents | - | - | - | - | - | - | 100.0 |
| Computer controlled vehicle & equipment | 10.0 | - | 100.0 | - | - | 10.0 | 80.0 |
| Comp. based vehicle & equip. maintenance | 20.0 | 50.0 | 50.0 | 50.0 | - | 20.0 | 60.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 30.0 | - | 66.7 | - | - | 10.0 | 60.0 |
| - underground | - | - | - | - | - | - | 100.0 |
| Data communication networks - open pit | 20.0 | 50.0 | 100.0 | - | - | - | 80.0 |
| Underground data communication networks | 10.0 | 100.0 | 100.0 | - | - | - | 90.0 |
| In plant data networks linking aut. processes | 10.0 | 100.0 | - | - | 100.0 | 10.0 | 80.0 |
| CONTROL | | | | | | | |
| Analog controllers | 20.0 | 50.0 | 50.0 | - | 50.0 | - | 80.0 |
| Programmable logic controllers (PLC) | 30.0 | 66.7 | 33.3 | 33.3 | 33.3 | 10.0 | 60.0 |
| On-line statistical process control | 10.0 | 100.0 | 100.0 | - | - | 10.0 | 80.0 |
| Supervisory control & data acquisition | 10.0 | 100.0 | 100.0 | - | - | - | 90.0 |
| Int. expert systems for process control | 20.0 | 100.0 | 100.0 | - | - | - | 80.0 |
| Aut. environmental monitoring & control | - | - | - | - | - | 10.0 | 90.0 |
| Automated T.V. image analysis | 10.0 | - | 100.0 | - | - | - | 90.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 20.0 | 50.0 | 100.0 | - | - | - | 80.0 |
| On-stream analysis (XRF) | - | - | - | - | - | 10.0 | 90.0 |
| On-stream size analysis | 10.0 | - | 100.0 | - | - | 10.0 | 80.0 |
| Flow density measurement | 30.0 | 33.3 | 100.0 | - | - | 20.0 | 50.0 |
| Inventory measurement | 10.0 | 100.0 | - | - | 100.0 | - | 90.0 |

**TABLE 17.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)**

Newfoundland

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 80.2 | 19.9 | 10.1 | 70.0 | 19.9 | - | 19.8 |
| Aut. conveyor - sequential analog | 56.2 | - | 100.0 | - | - | - | 43.8 |
| - computer control | 16.0 | 100.0 | 100.0 | - | - | - | 84.0 |
| Aut. slurry pumping - stop select | 24.0 | - | 33.6 | - | 66.4 | 10.3 | 65.6 |
| - var. speeds | 80.2 | 70.0 | 100.0 | - | - | 10.3 | 9.4 |
| Aut. handling equip. - ores | 72.1 | 22.1 | 100.0 | - | - | - | 27.9 |
| - slurries | 72.1 | 22.1 | 22.1 | 77.9 | - | 10.3 | 17.5 |
| - concentrates | 16.0 | 100.0 | 100.0 | - | - | - | 84.0 |
| - reagents | - | - | - | - | - | - | 100.0 |
| Computer controlled vehicle & equip. | 56.2 | - | 100.0 | - | - | 10.3 | 33.5 |
| Comp. based vehicle & equip. maintenance | 24.0 | 66.4 | 66.4 | 33.6 | - | 66.5 | 9.4 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 82.5 | - | 87.5 | - | - | 1.0 | 16.5 |
| - underground | - | - | - | - | - | - | 100.0 |
| Data communication networks - open pit | 72.1 | 22.1 | 100.0 | - | - | - | 27.9 |
| Underground data communication networks | 3.4 | 100.0 | 100.0 | - | - | - | 96.6 |
| In plant data networks linking aut. proc. | 16.0 | 100.0 | - | - | 100.0 | 56.2 | 27.9 |
| CONTROL | | | | | | | |
| Analog controllers | 24.0 | 66.4 | 33.6 | - | 66.4 | - | 76.0 |
| Programmable logic controllers (PLC) | 80.2 | 89.9 | 70.0 | 10.1 | 19.9 | 10.3 | 9.4 |
| On-line statistical process control | 56.2 | 100.0 | 100.0 | - | - | 16.0 | 27.9 |
| Supervisory control & data acquisition | 16.0 | 100.0 | 100.0 | - | - | - | 84.0 |
| Int. expert systems for process control | 72.1 | 100.0 | 100.0 | - | - | - | 27.9 |
| Aut. environmental monitoring & control | - | - | - | - | - | 56.2 | 43.8 |
| Automated T.V. image analysis | 16.0 | - | 100.0 | - | - | - | 84.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 72.1 | 22.1 | 100.0 | - | - | - | 27.9 |
| On-stream analysis (XRF) | - | - | - | - | - | 16.0 | 84.0 |
| On-stream size analysis | 56.2 | - | 100.0 | - | - | 10.3 | 33.5 |
| Flow density measurement | 80.2 | 19.9 | 100.0 | - | - | 13.7 | 6.0 |
| in-ventory measurement | 16.0 | 100.0 | - | - | 100.0 | - | 84.0 |

**TABLE 18.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

Nova Scotia

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 21.4 | - | 33.3 | 33.3 | - | 7.1 | 71.4 |
| Aut. conveyor - sequential analog | 7.1 | - | 100.0 | - | - | - | 92.9 |
| - computer control | 7.1 | - | 100.0 | - | - | 21.4 | 71.4 |
| Aut. slurry pumping - stop select | 7.1 | - | 100.0 | - | - | 7.1 | 85.7 |
| - var. speeds | 14.3 | - | 100.0 | - | - | 14.3 | 71.4 |
| Aut. handling equip. - ores | 7.1 | - | 100.0 | - | - | - | 92.9 |
| - slurries | 7.1 | - | 100.0 | - | - | 7.1 | 85.7 |
| - concentrates | - | - | - | - | - | 7.1 | 92.9 |
| - reagents | 7.1 | - | 100.0 | - | - | - | 92.9 |
| Computer controlled vehicle & equipment | - | - | - | - | - | 14.3 | 85.7 |
| Comp. based vehicle & equip. maintenance | 14.3 | - | 100.0 | - | - | 7.1 | 78.6 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 42.9 | 16.7 | 50.0 | 16.7 | 16.7 | - | 57.1 |
| - underground | 7.1 | - | 100.0 | - | - | 7.1 | 85.7 |
| Data communication networks - open pit | 7.1 | - | - | - | - | 7.1 | 85.7 |
| Underground data communication networks | - | - | - | - | - | 7.1 | 92.9 |
| In plant data networks linking aut. processes | 7.1 | - | 100.0 | - | - | 7.1 | 85.7 |
| CONTROL | | | | | | | |
| Analog controllers | 21.4 | - | 100.0 | - | - | - | 78.6 |
| Programmable logic controllers (PLC) | 28.6 | 25.0 | 75.0 | - | - | 14.3 | 57.1 |
| On-line statistical process control | - | - | - | - | - | 14.3 | 85.7 |
| Supervisory control & data acquisition | 7.1 | - | 100.0 | - | - | 14.3 | 78.6 |
| Int. expert systems for process control | - | - | - | - | - | 7.1 | 92.9 |
| Aut. environmental monitoring & control | 7.1 | - | 100.0 | - | - | 7.1 | 85.7 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 7.1 | 100.0 | 100.0 | - | - | 7.1 | 85.7 |
| On-stream size analysis | - | - | - | - | - | 7.1 | 92.9 |
| Flow density measurement | 14.3 | 50.0 | 50.0 | - | - | 7.1 | 78.6 |
| Inventory measurement | 14.3 | - | 50.0 | - | - | 7.1 | 78.6 |

## TABLE 18.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

Nova Scotia

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 40.7 | - | 17.8 | 42.2 | - | 6.2 | 53.1 |
| Aut. conveyor - sequential analog | 17.2 | - | 100.0 | - | - | - | 82.8 |
| - computer control | 7.2 | - | 100.0 | - | - | 44.3 | 48.4 |
| Aut. slurry pumping - stop select | 17.2 | - | 100.0 | - | - | 16.3 | 66.5 |
| - var. speeds | 23.3 | - | 100.0 | - | - | 36.2 | 40.4 |
| Aut. handling equip. - ores | 17.2 | - | 100.0 | - | - | - | 82.8 |
| - slurries | 17.2 | - | 100.0 | - | - | 19.9 | 62.9 |
| - concentrates | - | - | - | - | - | 17.2 | 82.8 |
| - reagents | 17.2 | - | 100.0 | - | - | - | 82.8 |
| Computer controlled vehicle & equip. | - | - | - | - | - | 13.4 | 86.6 |
| Comp. based vehicle & equip. maintenance | 23.3 | - | 100.0 | - | - | 16.3 | 60.4 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 51.4 | 14.1 | 61.9 | 14.1 | 14.1 | - | 48.6 |
| - underground | 3.5 | - | 100.0 | - | - | 19.9 | 76.6 |
| Data communication networks - open pit | 5.1 | - | - | - | - | 7.2 | 87.7 |
| Underground data communication networks | - | - | - | - | - | 19.9 | 80.1 |
| In plant data networks linking aut. proc. | 17.2 | - | 100.0 | - | - | 19.9 | 62.9 |
| CONTROL | | | | | | | |
| Analog controllers | 39.6 | - | 100.0 | - | - | - | 60.4 |
| Programmable logic controllers (PLC) | 44.7 | 36.5 | 88.7 | - | - | 27.2 | 28.1 |
| On-line statistical process control | - | - | - | - | - | 26.1 | 73.9 |
| Supervisory control & data acquisition | 17.2 | - | 100.0 | - | - | 26.1 | 56.7 |
| Int. expert systems for process control | - | - | - | - | - | 17.2 | 82.8 |
| Aut. environmental monitoring & control | 17.2 | - | 100.0 | - | - | 19.9 | 62.9 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 17.2 | 100.0 | 100.0 | - | - | 19.9 | 62.9 |
| On-stream size analysis | - | - | - | - | - | 19.9 | 80.1 |
| Flow density measurement | 22.2 | 77.2 | 77.2 | - | - | 19.9 | 57.8 |
| in-ventory measurement | 18.1 | - | 72.0 | - | - | 7.2 | 74.6 |

**TABLE 19.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

New Brunswick

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 37.5 | 33.3 | 33.3 | 66.7 | - | 25.0 | 37.5 |
| Aut. conveyor - sequential analog | 50.0 | 25.0 | 75.0 | - | - | 12.5 | 37.5 |
| - computer control | 37.5 | 33.3 | 100.0 | - | - | 12.5 | 50.0 |
| Aut. slurry pumping - stop select | 25.0 | - | 100.0 | - | - | - | 75.0 |
| - var. speeds | 50.0 | 25.0 | 100.0 | - | - | - | 50.0 |
| Aut. handling equip. - ores | 25.0 | - | 100.0 | - | - | 25.0 | 50.0 |
| - slurries | 50.0 | - | 100.0 | - | - | - | 50.0 |
| - concentrates | 37.5 | - | 100.0 | - | - | 12.5 | 50.0 |
| - reagents | 37.5 | 33.3 | 100.0 | - | - | 12.5 | 50.0 |
| Computer controlled vehicle & equipment | - | - | - | - | - | 12.5 | 87.5 |
| Comp. based vehicle & equip. maintenance | 25.0 | 50.0 | 50.0 | - | - | 25.0 | 50.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 25.0 | - | 50.0 | - | - | - | 75.0 |
| - underground | 12.5 | - | 100.0 | - | - | - | 87.5 |
| Data communication networks - open pit | 12.5 | - | 100.0 | - | - | - | 87.5 |
| Underground data communication networks | 25.0 | 100.0 | 100.0 | - | - | - | 75.0 |
| In plant data networks linking aut. processes | 50.0 | 25.0 | 100.0 | - | - | - | 50.0 |
| CONTROL | | | | | | | |
| Analog controllers | 37.5 | - | 100.0 | - | - | - | 62.5 |
| Programmable logic controllers (PLC) | 62.5 | 20.0 | 100.0 | - | - | - | 37.5 |
| On-line statistical process control | 25.0 | - | 100.0 | - | - | 37.5 | 37.5 |
| Supervisory control & data acquisition | 62.5 | 20.0 | 80.0 | - | - | - | 37.5 |
| Int. expert systems for process control | 25.0 | 50.0 | 100.0 | - | - | 12.5 | 62.5 |
| Aut. environmental monitoring & control | 62.5 | 20.0 | 80.0 | - | - | - | 37.5 |
| Automated T.V. image analysis | 12.5 | - | 100.0 | - | - | 12.5 | 75.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 50.0 | 25.0 | 100.0 | - | - | - | 50.0 |
| On-stream size analysis | 25.0 | - | 50.0 | 50.0 | - | - | 75.0 |
| Flow density measurement | 37.5 | 33.3 | 100.0 | - | - | - | 62.5 |
| Inventory measurement | 37.5 | 33.3 | 66.7 | - | - | - | 62.5 |

## TABLE 19.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

New Brunswick

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 77.0 | 64.4 | 15.2 | 84.8 | - | 12.1 | 11.0 |
| Aut. conveyor - sequential analog | 83.6 | 59.3 | 92.0 | - | - | 8.3 | 8.1 |
| - computer control | 77.0 | 64.4 | 100.0 | - | - | 8.3 | 14.8 |
| Aut. slurry pumping - stop select | 15.5 | - | 100.0 | - | - | - | 84.5 |
| - var. speeds | 80.8 | 61.4 | 100.0 | - | - | - | 19.2 |
| Aut. handling equip. - ores | 27.4 | - | 100.0 | - | - | 57.9 | 14.8 |
| - slurries | 80.8 | - | 100.0 | - | - | - | 19.2 |
| - concentrates | 31.2 | - | 100.0 | - | - | 49.6 | 19.2 |
| - reagents | 77.0 | 64.4 | 100.0 | - | - | 3.8 | 19.2 |
| Computer controlled vehicle & equip. | - | - | - | - | - | 8.3 | 91.7 |
| Comp. based vehicle & equip. maintenance | 56.3 | 88.1 | 88.1 | - | - | 12.1 | 31.7 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 14.9 | - | 55.3 | - | - | - | 85.1 |
| - underground | 11.7 | - | 100.0 | - | - | - | 88.3 |
| Data communication networks - open pit | 8.3 | - | 100.0 | - | - | - | 91.7 |
| Underground data communication networks | 61.3 | 100.0 | 100.0 | - | - | - | 38.7 |
| In plant data networks linking aut. proc. | 85.2 | 58.2 | 100.0 | - | - | - | 14.8 |
| CONTROL | | | | | | | |
| Analog controllers | 65.1 | - | 100.0 | - | - | - | 34.9 |
| Programmable logic controllers (PLC) | 89.0 | 55.7 | 100.0 | - | - | - | 11.0 |
| On-line statistical process control | 24.0 | - | 100.0 | - | - | 65.1 | 11.0 |
| Supervisory control & data acquisition | 89.0 | 55.7 | 95.7 | - | - | - | 11.0 |
| Int. expert systems for process control | 57.9 | 85.7 | 100.0 | - | - | 3.8 | 38.3 |
| Aut. environmental monitoring & control | 91.9 | 54.0 | 92.7 | - | - | - | 8.1 |
| Automated T.V. image analysis | 15.7 | - | 100.0 | - | - | 8.3 | 76.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 73.3 | 5.2 | 100.0 | - | - | - | 26.7 |
| On-stream size analysis | 57.9 | - | 14.3 | 85.7 | - | - | 42.1 |
| Flow density measurement | 69.5 | 71.3 | 100.0 | - | - | - | 30.5 |
| Inventory measurement | 67.9 | 73.0 | 90.2 | - | - | - | 32.1 |

## TABLE 20.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)

Quebec

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 32.8 | 21.1 | 78.9 | 15.8 | - | 12.1 | 55.2 |
| Aut. conveyor - sequential analog | 36.2 | 33.3 | 90.5 | 4.8 | - | 5.2 | 58.6 |
| - computer control | 19.0 | 45.5 | 72.7 | 9.1 | 9.1 | 6.9 | 74.1 |
| Aut. slurry pumping - stop select | 15.5 | 22.2 | 66.7 | 22.2 | - | 8.6 | 75.9 |
| - var. speeds | 13.8 | 37.5 | 75.0 | 12.5 | - | 12.1 | 74.1 |
| Aut. handling equip. - ores | 15.5 | 22.2 | 77.8 | - | - | 8.6 | 75.9 |
| - slurries | 10.3 | 50.0 | 66.7 | 33.3 | - | 8.6 | 81.0 |
| - concentrates | 19.0 | 27.3 | 81.8 | 9.1 | - | 8.6 | 72.4 |
| - reagents | 15.5 | 55.6 | 55.6 | 22.2 | - | 8.6 | 75.9 |
| Computer controlled vehicle & equipment | 13.8 | 50.0 | 75.0 | - | - | 13.8 | 72.4 |
| Comp. based vehicle & equip. maintenance | 19.0 | 54.5 | 63.6 | 9.1 | - | 6.9 | 74.1 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 17.2 | 10.0 | 80.0 | 10.0 | - | 1.7 | 81.0 |
| - underground | 13.8 | 37.5 | 75.0 | 12.5 | - | 10.3 | 75.9 |
| Data communication networks - open pit | 6.9 | 25.0 | 75.0 | - | - | - | 93.1 |
| Underground data communication networks | 17.2 | - | 70.0 | - | - | 8.6 | 74.1 |
| In plant data networks linking aut. processes | 15.5 | 44.4 | 77.8 | - | 11.1 | 5.2 | 79.3 |
| CONTROL | | | | | | | |
| Analog controllers | 27.6 | 31.3 | 87.5 | - | 6.3 | 6.9 | 65.5 |
| Programmable logic controllers (PLC) | 36.2 | 42.9 | 81.0 | - | 14.3 | 17.2 | 46.6 |
| On-line statistical process control | 6.9 | 50.0 | 75.0 | - | 25.0 | 20.7 | 72.4 |
| Supervisory control & data acquisition | 17.2 | 50.0 | 90.0 | - | - | 13.8 | 69.0 |
| Int. expert systems for process control | 10.3 | 66.7 | 83.3 | - | 16.7 | 8.6 | 81.0 |
| Aut. environmental monitoring & control | 13.8 | 37.5 | 75.0 | 12.5 | 12.5 | 12.1 | 74.1 |
| Automated T.V. image analysis | 10.3 | 50.0 | 83.3 | - | - | 6.9 | 82.8 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 17.2 | 30.0 | 90.0 | - | - | 12.1 | 70.7 |
| On-stream analysis (XRF) | 20.7 | 41.7 | 91.7 | - | - | 12.1 | 67.2 |
| On-stream size analysis | 3.4 | 50.0 | 50.0 | - | - | 8.6 | 87.9 |
| Flow density measurement | 22.4 | 30.8 | 84.6 | - | 7.7 | 12.1 | 65.5 |
| Inventory measurement | 17.2 | 30.0 | 70.0 | 20.0 | 10.0 | 6.9 | 75.9 |

## TABLE 20.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

Quebec

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 59.5 | 13.5 | 78.5 | 14.1 | - | 8.9 | 31.7 |
| Aut. conveyor - sequential analog | 54.8 | 41.2 | 87.2 | 4.7 | - | 6.1 | 39.1 |
| - computer control | 52.0 | 51.4 | 79.1 | 5.0 | 7.4 | 5.1 | 43.0 |
| Aut. slurry pumping - stop select | 42.4 | 13.2 | 78.2 | 11.3 | - | 7.3 | 50.3 |
| - var. speeds | 24.6 | 41.8 | 71.6 | 10.5 | - | 8.3 | 67.0 |
| Aut. handling equip. - ores | 42.8 | 18.1 | 86.3 | - | - | 11.2 | 46.1 |
| - slurries | 21.0 | 49.0 | 81.6 | 18.4 | - | 9.3 | 69.6 |
| - concentrates | 44.9 | 40.4 | 84.4 | 5.7 | - | 9.8 | 45.3 |
| - reagents | 27.1 | 47.7 | 52.0 | 26.9 | - | 11.0 | 61.8 |
| Computer controlled vehicle & equip. | 24.9 | 49.7 | 76.6 | - | - | 10.3 | 64.8 |
| Comp. based vehicle & equip. maintenance | 28.5 | 53.4 | 53.0 | 9.0 | - | 5.9 | 65.6 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 43.9 | 17.6 | 82.3 | 17.6 | - | 1.3 | 54.8 |
| - underground | 30.1 | 14.6 | 77.9 | 7.4 | - | 11.1 | 58.8 |
| Data communication networks - open pit | 25.0 | 30.9 | 99.8 | - | - | - | 75.0 |
| Underground data communication networks | 22.6 | - | 70.6 | - | - | 6.1 | 71.3 |
| In plant data networks linking aut. proc. | 34.5 | 29.6 | 88.4 | - | 7.5 | 1.8 | 63.7 |
| CONTROL | | | | | | | |
| Analog controllers | 56.0 | 29.6 | 87.5 | - | 4.6 | 6.5 | 37.5 |
| Programmable logic controllers (PLC) | 61.0 | 51.3 | 79.3 | - | 13.4 | 19.6 | 19.4 |
| On-line statistical process control | 11.3 | 49.2 | 77.3 | - | 22.7 | 38.7 | 49.9 |
| Supervisory control & data acquisition | 36.7 | 50.6 | 95.3 | - | - | 10.5 | 52.7 |
| Int. expert systems for process control | 25.7 | 28.1 | 90.0 | - | 10.0 | 16.2 | 58.1 |
| Aut. environmental monitoring & control | 39.6 | 33.7 | 83.7 | 9.8 | 6.5 | 12.6 | 47.9 |
| Automated T.V. image analysis | 19.2 | 57.2 | 76.9 | - | - | 4.1 | 76.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 27.4 | 41.9 | 83.8 | - | - | 9.0 | 63.7 |
| On-stream analysis (XRF) | 33.9 | 24.6 | 86.9 | - | - | 14.1 | 52.0 |
| On-stream size analysis | 9.2 | 51.6 | 51.6 | - | - | 14.2 | 76.7 |
| Flow density measurement | 37.2 | 36.4 | 81.2 | - | 6.9 | 7.8 | 55.0 |
| Inventory measurement | 25.9 | 28.7 | 48.8 | 41.2 | 10.0 | 9.7 | 64.4 |

**TABLE 21.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

Ontario

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 69.8 | 43.2 | 81.1 | 10.8 | 5.4 | - | 30.2 |
| Aut. conveyor - sequential analog | 45.3 | 16.7 | 83.3 | 4.2 | 8.3 | - | 54.7 |
| - computer control | 37.7 | 40.0 | 80.0 | - | 15.0 | 7.5 | 54.7 |
| Aut. slurry pumping - stop select | 39.6 | 23.8 | 100.0 | - | - | 7.5 | 52.8 |
| - var. speeds | 41.5 | 36.4 | 100.0 | - | - | 5.7 | 52.8 |
| Aut. handling equip. - ores | 45.3 | 37.5 | 87.5 | 4.2 | 8.3 | 3.8 | 50.9 |
| - slurries | 35.8 | 15.8 | 94.7 | - | 5.3 | 5.7 | 58.5 |
| - concentrates | 24.5 | 23.1 | 100.0 | - | - | 5.7 | 69.8 |
| - reagents | 34.0 | 22.2 | 100.0 | - | - | 11.3 | 54.7 |
| Computer controlled vehicle & equipment | 15.1 | 25.0 | 75.0 | 12.5 | 12.5 | 9.4 | 75.5 |
| Comp. based vehicle & equip. maintenance | 35.8 | 26.3 | 78.9 | 15.8 | 5.3 | 15.1 | 49.1 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 22.6 | 8.3 | 83.3 | 8.3 | - | - | 77.4 |
| - underground | 28.3 | 20.0 | 86.7 | 6.7 | - | 7.5 | 64.2 |
| Data communication networks - open pit | 5.7 | - | 100.0 | - | - | 1.9 | 92.5 |
| Underground data communication networks | 24.5 | 53.8 | 92.3 | - | 7.7 | 13.2 | 62.3 |
| In plant data networks linking aut. processes | 45.3 | 29.2 | 79.2 | 8.3 | 4.2 | 9.4 | 45.3 |
| CONTROL | | | | | | | |
| Analog controllers | 62.3 | 24.2 | 75.8 | 12.1 | 3.0 | 3.8 | 34.0 |
| Programmable logic controllers (PLC) | 69.8 | 35.1 | 78.4 | 8.1 | 5.4 | 7.5 | 22.6 |
| On-line statistical process control | 24.5 | 23.1 | 92.3 | - | - | 11.3 | 64.2 |
| Supervisory control & data acquisition | 32.1 | 29.4 | 82.4 | 5.9 | - | 11.3 | 56.6 |
| Int. expert systems for process control | 20.8 | 27.3 | 81.8 | 18.2 | - | 9.4 | 69.8 |
| Aut. environmental monitoring & control | 39.6 | 38.1 | 81.0 | 14.3 | - | 5.7 | 54.7 |
| Automated T.V. image analysis | 9.4 | - | 100.0 | - | - | 1.9 | 88.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 18.9 | 10.0 | 100.0 | - | - | 1.9 | 79.2 |
| On-stream analysis (XRF) | 26.4 | 14.3 | 92.9 | - | - | 3.8 | 69.8 |
| On-stream size analysis | 13.2 | - | 100.0 | - | - | 3.8 | 83.0 |
| Flow density measurement | 54.7 | 20.7 | 93.1 | 6.9 | - | 5.7 | 39.6 |
| Inventory measurement | 34.0 | 22.2 | 94.4 | 5.6 | - | 7.5 | 58.5 |

**TABLE 21.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)**

Ontario

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 90.0 | 52.4 | 75.6 | 20.9 | 3.3 | - | 10.0 |
| Aut. conveyor - sequential analog | 65.3 | 14.1 | 95.2 | 0.8 | 3.5 | - | 34.7 |
| - computer control | 64.8 | 44.1 | 93.7 | - | 5.7 | 5.4 | 29.8 |
| Aut. slurry pumping - stop select | 48.1 | 48.1 | 100.0 | - | - | 11.1 | 40.8 |
| - var. speeds | 77.5 | 47.2 | 100.0 | - | - | 2.7 | 19.9 |
| Aut. handling equip. - ores | 71.6 | 42.3 | 87.2 | 0.5 | 12.3 | 0.5 | 27.9 |
| - slurries | 65.8 | 20.8 | 88.7 | - | 11.3 | 1.1 | 33.0 |
| - concentrates | 54.4 | 25.1 | 100.0 | - | - | 1.1 | 44.4 |
| - reagents | 74.3 | 19.3 | 100.0 | - | - | 4.5 | 21.3 |
| Computer controlled vehicle & equip. | 34.5 | 25.4 | 37.3 | 2.5 | 60.2 | 14.7 | 50.8 |
| Comp. based vehicle & equip. maintenance | 59.4 | 13.6 | 52.2 | 12.9 | 34.9 | 5.6 | 35.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 33.5 | 2.1 | 94.4 | 0.3 | - | - | 66.5 |
| - underground | 59.6 | 38.1 | 95.5 | 1.6 | - | 4.1 | 36.3 |
| Data communication networks - open pit | 22.7 | - | 100.0 | - | - | 0.6 | 76.7 |
| Underground data communication networks | 52.2 | 87.9 | 60.3 | - | 39.7 | 17.1 | 30.7 |
| In plant data networks linking aut. proc. | 81.2 | 33.7 | 65.6 | 4.1 | 25.6 | 4.0 | 14.9 |
| CONTROL | | | | | | | |
| Analog controllers | 87.2 | 25.4 | 89.3 | 7.4 | 1.1 | 2.3 | 10.5 |
| Programmable logic controllers (PLC) | 85.8 | 38.6 | 94.0 | 1.8 | 1.9 | 6.5 | 7.7 |
| On-line statistical process control | 38.9 | 17.4 | 99.7 | - | - | 24.8 | 36.3 |
| Supervisory control & data acquisition | 70.0 | 34.8 | 91.5 | 5.9 | - | 6.1 | 23.9 |
| Int. expert systems for process control | 46.4 | 30.9 | 77.6 | 22.4 | - | 13.6 | 40.0 |
| Aut. environmental monitoring & control | 76.0 | 49.6 | 86.2 | 11.9 | - | 4.2 | 19.9 |
| Automated T.V. image analysis | 23.6 | - | 100.0 | - | - | 0.2 | 76.2 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 36.9 | 2.5 | 100.0 | - | - | 0.4 | 62.7 |
| On-stream analysis (XRF) | 62.6 | 9.9 | 99.0 | - | - | 1.1 | 36.3 |
| On-stream size analysis | 36.4 | - | 100.0 | - | - | 10.7 | 52.9 |
| Flow density measurement | 86.4 | 20.6 | 96.1 | 3.9 | - | 4.9 | 8.7 |
| Inventory measurement | 50.4 | 26.0 | 97.4 | 2.6 | - | 21.2 | 28.4 |

**TABLE 22.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

Manitoba

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 25.0 | 50.0 | 50.0 | 50.0 | - | - | 75.0 |
| Aut. conveyor - sequential analog | 37.5 | - | 100.0 | - | - | - | 62.5 |
| - computer control | 12.5 | - | 100.0 | - | - | - | 87.5 |
| Aut. slurry pumping - stop select | 12.5 | 100.0 | 100.0 | - | - | - | 87.5 |
| - var. speeds | 12.5 | - | 100.0 | - | - | 12.5 | 75.0 |
| Aut. handling equip. - ores | 37.5 | 33.3 | - | 33.3 | - | - | 62.5 |
| - slurries | 37.5 | 33.3 | - | 33.3 | - | - | 62.5 |
| - concentrates | 37.5 | 33.3 | - | 33.3 | - | - | 62.5 |
| - reagents | 37.5 | 33.3 | 33.3 | - | - | - | 62.5 |
| Computer controlled vehicle & equipment | 37.5 | 100.0 | - | - | - | - | 62.5 |
| Comp. based vehicle & equip. maintenance | 25.0 | 100.0 | - | - | - | 12.5 | 62.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 50.0 | - | 25.0 | - | - | - | 50.0 |
| - underground | 37.5 | 33.3 | 33.3 | - | - | 12.5 | 50.0 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 37.5 | 33.3 | 33.3 | - | - | - | 62.5 |
| In plant data networks linking aut. processes | 12.5 | 100.0 | - | - | - | 50.0 | 37.5 |
| CONTROL | | | | | | | |
| Analog controllers | 37.5 | - | 100.0 | - | - | - | 62.5 |
| Programmable logic controllers (PLC) | 25.0 | 100.0 | 100.0 | - | - | 12.5 | 62.5 |
| On-line statistical process control | 12.5 | 100.0 | 100.0 | - | - | 25.0 | 62.5 |
| Supervisory control & data acquisition | 12.5 | 100.0 | 100.0 | - | - | - | 87.5 |
| Int. expert systems for process control | 12.5 | 100.0 | - | - | - | 25.0 | 62.5 |
| Aut. environmental monitoring & control | 12.5 | - | - | - | 100.0 | 12.5 | 75.0 |
| Automated T.V. image analysis | 25.0 | - | - | - | - | - | 75.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 37.5 | 100.0 | 33.3 | - | - | - | 62.5 |
| On-stream size analysis | 25.0 | - | - | - | - | 12.5 | 62.5 |
| Flow density measurement | 62.5 | 20.0 | 40.0 | 20.0 | - | - | 37.5 |
| Inventory measurement | 50.0 | - | 25.0 | 25.0 | - | 12.5 | 37.5 |

## TABLE 22.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

Manitoba

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 56.1 | 5.0 | 5.0 | 95.0 | - | - | 43.9 |
| Aut. conveyor - sequential analog | 56.5 | - | 100.0 | - | - | - | 43.5 |
| - computer control | 53.2 | - | 100.0 | - | - | - | 46.8 |
| Aut. slurry pumping - stop select | 53.2 | 100.0 | 100.0 | - | - | - | 46.8 |
| - var. speeds | 53.2 | - | 100.0 | - | - | 2.8 | 43.9 |
| Aut. handling equip. - ores | 95.8 | 55.6 | - | 55.6 | - | - | 4.2 |
| - slurries | 95.8 | 55.6 | - | 55.6 | - | - | 4.2 |
| - concentrates | 95.8 | 55.6 | - | 55.6 | - | - | 4.2 |
| - reagents | 95.8 | 55.6 | 55.6 | - | - | - | 4.2 |
| Computer controlled vehicle & equip. | 95.8 | 100.0 | - | - | - | - | 4.2 |
| Comp. based vehicle & equip. maintenance | 42.6 | 100.0 | - | - | - | 0.7 | 56.7 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 96.2 | - | 0.4 | - | - | - | 3.8 |
| - underground | 95.8 | 55.6 | 55.6 | - | - | 2.8 | 1.3 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 95.8 | 55.6 | 55.6 | - | - | - | 4.2 |
| In plant data networks linking aut. proc. | 53.2 | 100.0 | - | - | - | 46.1 | 0.7 |
| CONTROL | | | | | | | |
| Analog controllers | 56.7 | - | 100.0 | - | - | - | 43.3 |
| Programmable logic controllers (PLC) | 56.1 | 100.0 | 100.0 | - | - | 0.7 | 43.3 |
| On-line statistical process control | 53.2 | 100.0 | 100.0 | - | - | 3.2 | 43.5 |
| Supervisory control & data acquisition | 53.2 | 100.0 | 100.0 | - | - | - | 46.8 |
| Int. expert systems for process control | 53.2 | 100.0 | - | - | - | 42.6 | 4.2 |
| Aut. environmental monitoring & control | 53.2 | - | - | - | 100.0 | 2.8 | 43.9 |
| Automated T.V. image analysis | 42.6 | - | - | - | - | - | 57.4 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 95.8 | 100.0 | 55.6 | - | - | - | 4.2 |
| On-stream size analysis | 42.6 | - | - | - | - | 53.2 | 4.2 |
| Flow density measurement | 99.1 | 2.8 | 3.3 | 53.7 | - | - | 0.9 |
| Inventory measurement | 98.7 | - | 2.9 | 54.0 | - | 0.4 | 0.9 |

## TABLE 23.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)

Saskatchewan

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 56.0 | 7.1 | 78.6 | 7.1 | - | - | 44.0 |
| Aut. conveyor - sequential analog | 36.0 | - | 100.0 | - | - | - | 64.0 |
| - computer control | 44.0 | 18.2 | 100.0 | - | - | 4.0 | 52.0 |
| Aut. slurry pumping - stop select | 48.0 | 16.7 | 100.0 | - | - | - | 52.0 |
| - var. speeds | 24.0 | - | 83.3 | 16.7 | - | 8.0 | 68.0 |
| Aut. handling equip. - ores | 28.0 | 14.3 | 85.7 | - | - | - | 72.0 |
| - slurries | 32.0 | 37.5 | 87.5 | - | - | - | 68.0 |
| - concentrates | 28.0 | 28.6 | 71.4 | - | - | - | 72.0 |
| - reagents | 32.0 | 37.5 | 75.0 | - | - | 4.0 | 64.0 |
| Computer controlled vehicle & equipment | 16.0 | 50.0 | 25.0 | 50.0 | - | 16.0 | 68.0 |
| Comp. based vehicle & equip. maintenance | 44.0 | 27.3 | 63.6 | 27.3 | - | 8.0 | 48.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 32.0 | - | 75.0 | 12.5 | - | - | 68.0 |
| - underground | 20.0 | - | 40.0 | 40.0 | - | 8.0 | 72.0 |
| Data communication networks - open pit | 8.0 | 50.0 | 100.0 | - | - | - | 92.0 |
| Underground data communication networks | 16.0 | 50.0 | 50.0 | - | - | 8.0 | 76.0 |
| In plant data networks linking aut. processes | 36.0 | 33.3 | 100.0 | - | - | 8.0 | 56.0 |
| CONTROL | | | | | | | |
| Analog controllers | 52.0 | 7.7 | 92.3 | - | - | 4.0 | 44.0 |
| Programmable logic controllers (PLC) | 60.0 | 33.3 | 86.7 | - | 6.7 | - | 40.0 |
| On-line statistical process control | 28.0 | 42.9 | 85.7 | - | 14.3 | 4.0 | 68.0 |
| Supervisory control & data acquisition | 28.0 | 42.9 | 85.7 | 14.3 | - | 4.0 | 68.0 |
| Int. expert systems for process control | 8.0 | 50.0 | 100.0 | - | - | 12.0 | 80.0 |
| Aut. environmental monitoring & control | 16.0 | 50.0 | 75.0 | - | 25.0 | 8.0 | 76.0 |
| Automated T.V. image analysis | 12.0 | 33.3 | 33.3 | 33.3 | - | - | 88.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 16.0 | 25.0 | 75.0 | 25.0 | - | - | 84.0 |
| On-stream analysis (XRF) | 24.0 | 66.7 | 83.3 | - | - | - | 76.0 |
| On-stream size analysis | 16.0 | 50.0 | 50.0 | - | 25.0 | 4.0 | 80.0 |
| Flow density measurement | 52.0 | 15.4 | 84.6 | - | - | 4.0 | 44.0 |
| Inventory measurement | 28.0 | 14.3 | 71.4 | 14.3 | - | 8.0 | 64.0 |

## TABLE 23.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

Saskatchewan

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 74.2 | 25.5 | 87.5 | 3.1 | - | - | 25.8 |
| Aut. conveyor - sequential analog | 47.5 | - | 100.0 | - | - | - | 52.5 |
| - computer control | 66.6 | 39.1 | 100.0 | - | - | 3.2 | 30.2 |
| Aut. slurry pumping - stop select | 62.0 | 12.8 | 100.0 | - | - | - | 38.0 |
| - var. speeds | 31.6 | - | 79.1 | 20.9 | - | 3.9 | 64.5 |
| Aut. handling equip. - ores | 58.6 | 32.2 | 74.2 | - | - | - | 41.4 |
| - slurries | 65.0 | 41.3 | 76.7 | - | - | - | 35.0 |
| - concentrates | 59.4 | 43.9 | 69.3 | - | - | - | 40.6 |
| - reagents | 60.2 | 44.6 | 69.6 | - | - | 6.2 | 33.6 |
| Computer controlled vehicle & equip. | 42.4 | 80.2 | 1.1 | 63.3 | - | 20.7 | 36.9 |
| Comp. based vehicle & equip. maintenance | 73.8 | 55.8 | 67.0 | 12.6 | - | 3.1 | 23.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 48.8 | - | 61.3 | 7.7 | - | - | 51.2 |
| - underground | 32.6 | - | 39.3 | 14.4 | - | 7.9 | 59.4 |
| Data communication networks - open pit | 5.5 | 42.8 | 100.0 | - | - | - | 94.5 |
| Underground data communication networks | 40.9 | 48.0 | 61.2 | - | - | 13.8 | 45.3 |
| In plant data networks linking aut. proc. | 50.8 | 57.6 | 100.0 | - | - | 17.5 | 31.7 |
| CONTROL | | | | | | | |
| Analog controllers | 60.0 | 31.5 | 96.1 | - | - | 0.5 | 39.5 |
| Programmable logic controllers (PLC) | 74.5 | 47.6 | 96.6 | - | 2.4 | - | 25.5 |
| On-line statistical process control | 44.0 | 64.2 | 92.8 | - | 7.2 | 7.2 | 48.8 |
| Supervisory control & data acquisition | 45.3 | 62.8 | 85.4 | 14.6 | - | 2.4 | 52.3 |
| Int. expert systems for process control | 3.1 | 24.5 | 100.0 | - | - | 41.2 | 55.7 |
| Aut. environmental monitoring & control | 35.0 | 74.5 | 93.4 | - | 6.6 | 3.1 | 61.8 |
| Automated T.V. image analysis | 40.6 | 46.5 | 16.3 | 46.5 | - | - | 59.4 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 38.9 | 48.5 | 51.5 | 48.5 | - | - | 61.1 |
| On-stream analysis (XRF) | 51.7 | 81.1 | 70.8 | - | - | - | 48.3 |
| On-stream size analysis | 37.1 | 53.0 | 53.0 | - | 6.3 | 7.2 | 55.7 |
| Flow density meesurement | 80.6 | 32.3 | 78.3 | - | - | 0.5 | 18.9 |
| Inventory measurement | 53.7 | 35.2 | 66.0 | 5.9 | - | 7.7 | 38.7 |

TABLE 24.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)

Alberta

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 37.5 | - | 66.7 | - | - | - | 62.5 |
| Aut. conveyor - sequential analog | 25.0 | - | 100.0 | - | - | - | 75.0 |
| - computer control | - | - | - | - | - | 12.5 | 87.5 |
| Aut. slurry pumping - stop select | 37.5 | - | 66.7 | 33.3 | - | - | 62.5 |
| - var. speeds | 25.0 | - | 50.0 | 50.0 | - | - | 75.0 |
| Aut. handling equip. - ores | - | - | - | - | - | 12.5 | 87.5 |
| - slurries | 12.5 | - | - | - | - | 12.5 | 75.0 |
| - concentrates | - | - | - | - | - | 12.5 | 87.5 |
| - reagents | - | - | - | - | - | 12.5 | 87.5 |
| Computer controlled vehicle & equipment | 12.5 | - | 100.0 | - | - | - | 87.5 |
| Comp. based vehicle & equip. maintenance | 37.5 | 66.7 | 100.0 | - | - | 12.5 | 50.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 50.0 | - | 100.0 | - | - | - | 50.0 |
| - underground | 12.5 | - | 100.0 | - | - | - | 87.5 |
| Data communication networks - open pit | 25.0 | - | 100.0 | - | - | 12.5 | 62.5 |
| Underground data communication networks | - | - | - | - | - | - | 100.0 |
| In plant data networks linking aut. processes | 12.5 | - | 100.0 | - | - | 12.5 | 75.0 |
| CONTROL | | | | | | | |
| Analog controllers | 50.0 | - | 100.0 | - | - | - | 50.0 |
| Programmable logic controllers (PLC) | 62.5 | 40.0 | 80.0 | - | 20.0 | - | 37.5 |
| On-line statistical process control | 12.5 | - | - | - | 100.0 | 12.5 | 75.0 |
| Supervisory control & data acquisition | 25.0 | 50.0 | 100.0 | - | - | 12.5 | 62.5 |
| Int. expert systems for process control | - | - | - | - | - | 12.5 | 87.5 |
| Aut. environmental monitoring & control | 50.0 | - | 100.0 | - | - | - | 50.0 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 12.5 | 100.0 | 100.0 | - | - | - | 87.5 |
| On-stream size analysis | - | - | - | - | - | - | 100.0 |
| Flow density measurement | 50.0 | - | 100.0 | - | - | - | 50.0 |
| Inventory measurement | 25.0 | - | 100.0 | - | - | - | 75.0 |

## TABLE 24.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

Alberta

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 43.4 | - | 50.3 | - | - | - | 56.6 |
| Aut. conveyor - sequential analog | 40.3 | - | 100.0 | - | - | - | 59.7 |
| - computer control | - | - | - | - | - | 21.5 | 78.5 |
| Aut. slurry pumping - stop select | 31.4 | - | 78.4 | 21.6 | - | - | 68.6 |
| - var. speeds | 28.3 | - | 76.0 | 24.0 | - | - | 71.7 |
| Aut. handling equip. - ores | - | - | - | - | - | 21.5 | 78.5 |
| - slurries | 6.8 | - | - | - | - | 21.5 | 71.7 |
| - concentrates | - | - | - | - | - | 21.5 | 78.5 |
| - reagents | - | - | - | - | - | 21.5 | 78.5 |
| Computer controlled vehicle & equip. | 6.8 | - | 100.0 | - | - | - | 93.2 |
| Comp. based vehicle & equip. maintenance | 55.7 | 87.8 | 100.0 | - | - | 18.7 | 25.6 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 43.3 | - | 100.0 | - | - | - | 56.7 |
| - underground | 21.5 | - | 100.0 | - | - | - | 78.5 |
| Data communication networks - open pit | 28.3 | - | 100.0 | - | - | 18.7 | 52.9 |
| Underground data communication networks | - | - | - | - | - | - | 100.0 |
| In plant data networks linking aut. proc. | 46.8 | - | 100.0 | - | - | 21.5 | 31.6 |
| CONTROL | | | | | | | |
| Analog controllers | 73.5 | - | 100.0 | - | - | - | 26.5 |
| Programmable logic controllers (PLC) | 95.9 | 71.3 | 92.9 | - | 7.1 | - | 4.1 |
| On-line statistical process control | 6.8 | - | - | - | 100.0 | 21.5 | 71.7 |
| Supervisory control & data acquisition | 48.9 | 95.8 | 100.0 | - | - | 21.5 | 29.6 |
| Int. expert systems for process control | - | - | - | - | - | 21.5 | 78.5 |
| Aut. environmental monitoring & control | 90.2 | - | 100.0 | - | - | - | 9.8 |
| Automated T.V. image analysis | - | - | - | - | - | - | 100.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | 46.8 | 100.0 | 100.0 | - | - | - | 53.2 |
| On-stream size analysis | - | - | - | - | - | - | 100.0 |
| Flow density measurement | 78.2 | - | 100.0 | - | - | - | 21.8 |
| Inventory measurement | 53.6 | - | 100.0 | - | - | - | 46.4 |

**TABLE 25.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

British Columbia

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 53.8 | 23.8 | 85.7 | 9.5 | - | 2.6 | 43.6 |
| Aut. conveyor - sequential analog | 35.9 | 14.3 | 78.6 | - | - | 2.6 | 61.5 |
| - computer control | 33.3 | 15.4 | 92.3 | - | - | 10.3 | 56.4 |
| Aut. slurry pumping - stop select | 48.7 | 10.5 | 89.5 | - | - | 5.1 | 46.2 |
| - var. speeds | 43.6 | 11.8 | 82.4 | 5.9 | - | 10.3 | 46.2 |
| Aut. handling equip. - ores | 35.9 | 14.3 | 78.6 | - | 7.1 | 7.7 | 56.4 |
| - slurries | 38.5 | 26.7 | 93.3 | - | - | 12.8 | 48.7 |
| - concentrates | 23.1 | 11.1 | 88.9 | - | - | 10.3 | 66.7 |
| - reagents | 25.6 | 40.0 | 80.0 | - | 10.0 | 17.9 | 56.4 |
| Computer controlled vehicle & equipment | 12.8 | - | 100.0 | - | - | 7.7 | 79.5 |
| Comp. based vehicle & equip. maintenance | 30.8 | 25.0 | 75.0 | 25.0 | - | 12.8 | 56.4 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 66.7 | 7.7 | 69.2 | 7.7 | - | 2.6 | 30.8 |
| - underground | 7.7 | - | 66.7 | - | - | 7.7 | 84.6 |
| Data communication networks - open pit | 17.9 | 28.6 | 57.1 | 14.3 | 14.3 | 15.4 | 66.7 |
| Underground data communication networks | 5.1 | - | 100.0 | - | - | 5.1 | 89.7 |
| In plant data networks linking aut. processes | 23.1 | 44.4 | 88.9 | - | - | 17.9 | 59.0 |
| CONTROL | | | | | | | |
| Analog controllers | 56.4 | 18.2 | 59.1 | 4.5 | - | 7.7 | 35.9 |
| Programmable logic controllers (PLC) | 56.4 | 45.5 | 63.6 | - | 4.5 | 10.3 | 33.3 |
| On-line statistical process control | 12.8 | 60.0 | 40.0 | - | - | 28.2 | 59.0 |
| Supervisory control & data acquisition | 15.4 | 50.0 | 66.7 | - | - | 23.1 | 61.5 |
| Int. expert systems for process control | 5.1 | - | - | - | - | 23.1 | 71.8 |
| Aut. environmental monitoring & control | 30.8 | 16.7 | 58.3 | 8.3 | - | 15.4 | 53.8 |
| Automated T.V. image analysis | 2.6 | - | - | - | - | 7.7 | 89.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 5.1 | 50.0 | 100.0 | - | - | 7.7 | 87.2 |
| On-stream analysis (XRF) | 25.6 | 20.0 | 80.0 | - | - | 10.3 | 64.1 |
| On-stream size analysis | 7.7 | - | - | 66.7 | - | 10.3 | 82.1 |
| Flow density measurement | 48.7 | 21.1 | 68.4 | 10.5 | - | 12.8 | 38.5 |
| Inventory measurement | 15.4 | 16.7 | 50.0 | 16.7 | - | 10.3 | 74.4 |

## TABLE 25.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

British Columbia

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 85.9 | 18.4 | 83.0 | 15.9 | - | 0.2 | 13.8 |
| Aut. conveyor - sequential analog | 58.9 | 5.6 | 80.0 | - | - | 0.2 | 40.9 |
| - computer control | 52.7 | 5.9 | 99.5 | - | - | 10.4 | 36.9 |
| Aut. slurry pumping - stop select | 84.1 | 12.8 | 95.5 | - | - | 0.6 | 15.3 |
| - var. speeds | 63.8 | 9.4 | 79.9 | 14.1 | - | 12.8 | 23.4 |
| Aut. handling equip. - ores | 62.8 | 9.6 | 74.7 | - | 9.0 | 1.0 | 36.2 |
| - slurries | 66.4 | 22.4 | 95.7 | - | - | 13.3 | 20.3 |
| - concentrates | 45.9 | 3.7 | 83.9 | - | - | 4.7 | 49.4 |
| - reagents | 39.2 | 38.1 | 87.1 | - | 12.2 | 29.2 | 31.6 |
| Computer controlled vehicle & equip. | 31.8 | - | 100.0 | - | - | 3.5 | 64.6 |
| Comp. based vehicle & equip. maintenance | 54.5 | 16.3 | 92.7 | 7.3 | - | 10.0 | 35.5 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 81.0 | 0.7 | 74.0 | 15.2 | - | 0.2 | 18.8 |
| - underground | 14.0 | - | 93.3 | - | - | 1.0 | 85.0 |
| Data communication networks - open pit | 38.1 | 37.6 | 78.6 | 6.7 | 10.7 | 22.0 | 39.9 |
| Underground data communication networks | 13.0 | - | 100.0 | - | - | 0.6 | 86.4 |
| In plant data networks linking aut. proc. | 47.6 | 24.9 | 94.0 | - | - | 23.4 | 28.9 |
| CONTROL | | | | | | | |
| Analog controllers | 81.6 | 10.3 | 65.9 | 4.3 | - | 1.0 | 17.5 |
| Programmable logic controllers (PLC) | 84.1 | 51.1 | 69.8 | - | 3.6 | 8.1 | 7.8 |
| On-line statistical process control | 16.2 | 86.6 | 70.9 | - | - | 39.9 | 43.9 |
| Supervisory control & data acquisition | 34.6 | 42.5 | 82.6 | - | - | 26.8 | 38.6 |
| Int. expert systems for process control | 3.8 | - | - | - | - | 31.8 | 64.4 |
| Aut. environmental monitoring & control | 48.9 | 6.3 | 88.8 | 1.8 | - | 12.0 | 39.2 |
| Automated T.V. image analysis | 1.6 | - | - | - | - | 11.4 | 87.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | 2.0 | 21.1 | 100.0 | - | - | 5.9 | 92.1 |
| On-stream analysis (XRF) | 50.1 | 33.8 | 89.2 | - | - | 25.0 | 24.9 |
| On-stream size analysis | 18.4 | - | - | 84.4 | - | 5.5 | 76.1 |
| Flow density measurement | 77.1 | 11.3 | 88.1 | 4.9 | - | 13.5 | 9.4 |
| Inventory measurement | 20.4 | 7.4 | 50.9 | 27.7 | - | 2.2 | 77.4 |

**TABLE 26.1 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY MINES)**

Northwest Territories

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 62.5 | - | 80.0 | 20.0 | - | - | 37.5 |
| Aut. conveyor - sequential analog | 37.5 | - | 66.7 | - | 33.3 | - | 62.5 |
| - computer control | 25.0 | - | 50.0 | - | - | - | 75.0 |
| Aut. slurry pumping - stop select | 62.5 | - | 80.0 | - | - | - | 37.5 |
| - var. speeds | 62.5 | 20.0 | 40.0 | 20.0 | 20.0 | - | 37.5 |
| Aut. handling equip. - ores | 25.0 | - | 50.0 | - | - | 12.5 | 62.5 |
| - slurries | 37.5 | - | 66.7 | - | - | - | 62.5 |
| - concentrates | 25.0 | - | 100.0 | - | - | - | 75.0 |
| - reagents | 25.0 | - | 50.0 | - | - | 12.5 | 62.5 |
| Computer controlled vehicle & equipment | - | - | - | - | - | 12.5 | 87.5 |
| Comp. based vehicle & equip. maintenance | 37.5 | - | - | 66.7 | - | 12.5 | 50.0 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 37.5 | - | 33.3 | 33.3 | - | - | 62.5 |
| - underground | 25.0 | - | 50.0 | 50.0 | - | - | 75.0 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 25.0 | - | 50.0 | - | 50.0 | 12.5 | 62.5 |
| In plant data networks linking aut. processes | 25.0 | - | 50.0 | - | - | - | 75.0 |
| CONTROL | | | | | | | |
| Analog controllers | 75.0 | 33.3 | 66.7 | - | 16.7 | - | 25.0 |
| Programmable logic controllers (PLC) | 75.0 | 16.7 | 50.0 | 16.7 | 16.7 | - | 25.0 |
| On-line statistical process control | 25.0 | 50.0 | 100.0 | - | - | - | 75.0 |
| Supervisory control & data acquisition | 12.5 | 100.0 | 100.0 | - | - | - | 87.5 |
| Int. expert systems for process control | - | - | - | - | - | - | 100.0 |
| Aut. environmental monitoring & control | 25.0 | - | 100.0 | - | - | - | 75.0 |
| Automated T.V. image analysis | 12.5 | - | 100.0 | - | - | - | 87.5 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | - | - | - | - | - | 12.5 | 87.5 |
| On-stream size analysis | - | - | - | - | - | 12.5 | 87.5 |
| Flow density measurement | 75.0 | 16.7 | 66.7 | - | - | - | 25.0 |
| Inventory measurement | 25.0 | - | 100.0 | - | - | - | 75.0 |

## TABLE 26.2 THE USE OF TECHNOLOGY BY PROVINCE OF OPERATION (WEIGHTED BY EMPLOYEES)

Northwest Territories

| Technologies | YES | | | | | NO | |
|---|---|---|---|---|---|---|---|
| | Currently use | Plan to increase usage | Expectations met | Expectations not met | Expectations exceeded | Plan to use | No plan to use |
| | % | % | % | % | % | % | % |
| AUTOMATED MATERIAL HANDLING | | | | | | | |
| Automatic bin level measurement | 67.0 | - | 84.9 | 15.1 | - | - | 33.0 |
| Aut. conveyor - sequential analog | 53.9 | - | 93.6 | - | 6.4 | - | 46.1 |
| - computer control | 45.9 | - | 60.5 | - | - | - | 54.1 |
| Aut. slurry pumping - stop select | 81.7 | - | 77.8 | - | - | - | 18.3 |
| - var. speeds | 75.1 | 4.0 | 34.8 | 4.0 | 37.0 | - | 24.9 |
| Aut. handling equip. - ores | 45.9 | - | 60.5 | - | - | 10.1 | 44.0 |
| - slurries | 68.6 | - | 73.6 | - | - | - | 31.4 |
| - concentrates | 25.7 | - | 100.0 | - | - | - | 74.3 |
| - reagents | 40.8 | - | 55.6 | - | - | 27.8 | 31.4 |
| Computer controlled vehicle & equip. | - | - | - | - | - | 3.0 | 97.0 |
| Comp. based vehicle & equip. maintenance | 56.0 | - | - | 67.6 | - | 3.0 | 40.9 |
| COMMUNICATIONS & NETWORKS | | | | | | | |
| Radio based voice networks - open pit | 24.6 | - | 14.0 | 12.3 | - | - | 75.4 |
| - underground | 50.5 | - | 44.9 | 55.1 | - | - | 49.5 |
| Data communication networks - open pit | - | - | - | - | - | - | 100.0 |
| Underground data communication networks | 50.5 | - | 44.9 | - | 55.1 | 10.1 | 39.4 |
| In plant data networks linking aut. proc. | 45.9 | - | 60.5 | - | - | - | 54.1 |
| CONTROL | | | | | | | |
| Analog controllers | 87.2 | 35.4 | 47.3 | - | 31.9 | - | 12.8 |
| Programmable logic controllers (PLC) | 87.2 | 3.5 | 43.3 | 31.9 | 4.0 | - | 12.8 |
| On-line statistical process control | 50.5 | 55.1 | 100.0 | - | - | - | 49.5 |
| Supervisory control & data acquisition | 27.8 | 100.0 | 100.0 | - | - | - | 72.2 |
| Int. expert systems for process control | - | - | - | - | - | - | 100.0 |
| Aut. environmental monitoring & control | 26.1 | - | 100.0 | - | - | - | 73.9 |
| Automated T.V. image analysis | 10.1 | - | 100.0 | - | - | - | 89.9 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | |
| Near-stream analysis | - | - | - | - | - | - | 100.0 |
| On-stream analysis (XRF) | - | - | - | - | - | 12.1 | 87.9 |
| On-stream size analysis | - | - | - | - | - | 27.8 | 72.2 |
| Flow density measurement | 87.2 | 3.5 | 65.3 | - | - | - | 12.8 |
| Inventory measurement | 26.1 | - | 100.0 | - | - | - | 73.9 |

**TABLE 27.1 THE USE OF TECHNOLOGY BY SIZE OF OPERATION (WEIGHTED BY MINES)**

| Technologies | Currently use | | | Plan to use | | | No plan to use | | |
|---|---|---|---|---|---|---|---|---|---|
| | % | | | % | | | % | | |
| | Employees | | | Employees | | | Employees | | |
| | 0 - 49 | 50-249 | > 249 | 0 - 49 | 50-249 | > 249 | 0 - 49 | 50-249 | > 249 |
| AUTOMATED MATERIAL HANDLING | - | - | - | - | - | - | - | - | - |
| Automatic bin level measurement | 16.4 | 41.9 | 78.0 | 6.0 | 7.0 | 2.4 | 77.6 | 51.2 | 19.5 |
| Aut. conveyor - sequential analog | 16.4 | 31.4 | 54.9 | 3.0 | 1.2 | 3.7 | 80.6 | 67.4 | 41.5 |
| - computer control | 3.0 | 17.4 | 56.1 | 7.5 | 8.1 | 8.5 | 89.6 | 74.4 | 35.4 |
| Aut. slurry pumping - stop select | 3.0 | 30.2 | 58.5 | 7.5 | 5.8 | 3.7 | 89.6 | 64.0 | 37.8 |
| - var. speeds | 3.0 | 25.6 | 56.1 | 10.4 | 8.1 | 9.8 | 86.6 | 66.3 | 34.1 |
| Aut. handling equip. - ores | 1.5 | 17.4 | 58.5 | 6.0 | 7.0 | 7.3 | 92.5 | 75.6 | 34.1 |
| - slurries | 1.5 | 17.4 | 57.3 | 4.5 | 8.1 | 7.3 | 94.0 | 74.4 | 35.4 |
| - concentrates | 1.5 | 16.3 | 42.7 | 4.5 | 9.3 | 4.9 | 94.0 | 74.4 | 52.4 |
| - reagents | 4.5 | 14.0 | 47.6 | 7.5 | 9.3 | 13.4 | 88.1 | 76.7 | 39.0 |
| Computer controlled vehicle & equipment | 3.0 | 10.5 | 24.4 | 6.0 | 12.8 | 12.2 | 91.0 | 76.7 | 63.4 |
| Comp. based vehicle & equip. maintenance | 9.0 | 24.4 | 51.2 | 11.9 | 14.0 | 9.8 | 79.1 | 61.6 | 39.0 |
| COMMUNICATIONS & NETWORKS | - | - | - | - | - | - | - | - | - |
| Radio based voice networks - open pit | 22.4 | 31.4 | 46.3 | 4.5 | 1.2 | - | 73.1 | 67.4 | 53.7 |
| - underground | 3.0 | 12.8 | 32.9 | 6.0 | 9.3 | 7.3 | 91.0 | 77.9 | 59.8 |
| Data communication networks - open pit | 1.5 | 7.0 | 18.3 | 4.5 | 3.5 | 3.7 | 94.0 | 89.5 | 78.0 |
| Underground data communication networks | 4.5 | 10.5 | 30.5 | 4.5 | 8.1 | 9.8 | 91.0 | 81.4 | 59.8 |
| In plant data networks linking aut. processes | 3.0 | 16.3 | 54.9 | 9.0 | 8.1 | 14.6 | 88.1 | 75.6 | 30.5 |
| CONTROL | - | - | - | - | - | - | - | - | - |
| Analog controllers | 13.4 | 45.3 | 70.7 | 4.5 | 5.8 | 2.4 | 82.1 | 48.8 | 26.8 |
| Programmable logic controllers (PLC) | 13.4 | 54.7 | 78.0 | 9.0 | 8.1 | 12.2 | 77.6 | 37.2 | 9.8 |
| On-line statistical process control | 4.5 | 10.5 | 29.3 | 13.4 | 12.8 | 23.2 | 82.1 | 76.7 | 47.6 |
| Supervisory control & data acquisition | 1.5 | 15.1 | 46.3 | 10.4 | 11.6 | 12.2 | 88.1 | 73.3 | 41.5 |
| Int. expert systems for process control | 6.0 | 4.7 | 22.0 | 7.5 | 8.1 | 18.3 | 86.6 | 87.2 | 59.8 |
| Aut. environmental monitoring & control | 1.5 | 19.8 | 50.0 | 6.0 | 11.6 | 8.5 | 92.5 | 68.6 | 41.5 |
| Automated T.V. image analysis | 3.0 | 7.0 | 14.6 | 6.0 | 3.5 | 2.4 | 91.0 | 89.5 | 82.9 |
| AUTOMATED PROCESSING SYSTEMS | - | - | - | - | - | - | - | - | - |
| Near-stream analysis | 6.0 | 5.8 | 23.2 | 6.0 | 4.7 | 3.7 | 88.1 | 89.5 | 73.2 |
| On-stream analysis (XRF) | 1.5 | 14.0 | 47.6 | 4.5 | 8.1 | 7.3 | 94.0 | 77.9 | 45.1 |
| On-stream size analysis | 1.5 | 3.5 | 20.7 | 3.0 | 5.8 | 11.0 | 95.5 | 90.7 | 68.3 |
| Flow density measurement | 9.0 | 36.0 | 74.4 | 7.5 | 8.1 | 8.5 | 83.6 | 55.8 | 17.1 |
| Inventory measurement | 3.0 | 24.4 | 39.0 | 10.4 | 5.8 | 4.9 | 86.6 | 69.8 | 56.1 |

TABLE 28.1 THE USE OF TECHNOLOGY BY MINING METHOD (WEIGHTED BY MINES)

| Technologies | Currently use | | Plan to use | | No plan to use | |
|---|---|---|---|---|---|---|
| | % | | % | | % | |
| | Method | | Method | | Method | |
| | Selective | Bulk | Selective | Bulk | Selective | Bulk |
| AUTOMATED MATERIAL HANDLING | | | | | | |
| Automatic bin level measurement | 40.9 | 51.0 | 1.7 | 7.0 | 57.4 | 42.0 |
| Aut. conveyor - sequential analog | 28.7 | 39.0 | 2.6 | 3.0 | 68.7 | 58.0 |
| - computer control | 24.3 | 30.0 | 3.5 | 12.0 | 72.2 | 58.0 |
| Aut. slurry pumping - stop select | 35.7 | 29.0 | 5.2 | 6.0 | 59.1 | 65.0 |
| - var. speeds | 28.7 | 31.0 | 9.6 | 8.0 | 61.7 | 61.0 |
| Aut. handling equip. - ores | 26.1 | 29.0 | 7.8 | 6.0 | 66.1 | 65.0 |
| - slurries | 29.6 | 25.0 | 6.1 | 8.0 | 64.3 | 67.0 |
| - concentrates | 18.3 | 23.0 | 7.0 | 5.0 | 74.8 | 72.0 |
| - reagents | 21.7 | 23.0 | 11.3 | 8.0 | 67.0 | 69.0 |
| Computer controlled vehicle & equipment | 10.4 | 12.0 | 8.7 | 12.0 | 80.9 | 76.0 |
| Comp. based vehicle & equip. maintenance | 32.2 | 26.0 | 10.4 | 11.0 | 57.4 | 63.0 |
| COMMUNICATIONS & NETWORKS | | | | | | |
| Radio based voice networks - open pit | 28.7 | 42.0 | 1.7 | 2.0 | 69.6 | 56.0 |
| - underground | 19.1 | 13.0 | 11.3 | 5.0 | 69.6 | 82.0 |
| Data communication networks - open pit | 6.1 | 15.0 | 2.6 | 6.0 | 91.3 | 79.0 |
| Underground data communication networks | 21.7 | 9.0 | 9.6 | 7.0 | 68.7 | 84.0 |
| In plant data networks linking aut. processes | 26.1 | 26.0 | 10.4 | 11.0 | 63.5 | 63.0 |
| CONTROL | | | | | | |
| Analog controllers | 42.6 | 46.0 | 1.7 | 5.0 | 55.7 | 49.0 |
| Programmable logic controllers (PLC) | 48.7 | 54.0 | 7.8 | 9.0 | 43.5 | 37.0 |
| On-line statistical process control | 14.8 | 16.0 | 13.9 | 19.0 | 71.3 | 65.0 |
| Supervisory control & data acquisition | 21.7 | 22.0 | 7.8 | 14.0 | 70.4 | 64.0 |
| Int. expert systems for process control | 10.4 | 10.0 | 8.7 | 15.0 | 80.9 | 75.0 |
| Aut. environmental monitoring & control | 27.8 | 21.0 | 7.8 | 10.0 | 64.3 | 69.0 |
| Automated T.V. image analysis | 6.1 | 11.0 | 2.6 | 5.0 | 91.3 | 84.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | |
| Near-stream analysis | 11.3 | 13.0 | 4.3 | 4.0 | 84.3 | 83.0 |
| On-stream analysis (XRF) | 16.5 | 27.0 | 5.2 | 8.0 | 78.3 | 65.0 |
| On-stream size analysis | 10.4 | 7.0 | 5.2 | 8.0 | 84.3 | 85.0 |
| Flow density measurement | 39.1 | 43.0 | 8.7 | 7.0 | 52.2 | 50.0 |
| Inventory measurement | 23.5 | 23.0 | 5.2 | 8.0 | 71.3 | 69.0 |

TABLE 28.2 THE USE OF TECHNOLOGY BY MINING METHOD (WEIGHTED BY EMPLOYEES)

| Technologies | Currently use | | Plan to use | | No plan to use | |
|---|---|---|---|---|---|---|
| | % | | % | | % | |
| | Selective | Bulk | Selective | Bulk | Selective | Bulk |
| AUTOMATED MATERIAL HANDLING | | | | | | |
| Automatic bin level measurement | 67.9 | 82.9 | 0.5 | 3.6 | 31.6 | 13.5 |
| Aut. conveyor - sequential analog | 42.8 | 73.0 | 1.7 | 1.5 | 55.6 | 25.5 |
| computer control | 44.5 | 61.6 | 1.7 | 12.3 | 53.8 | 26.1 |
| Aut. slurry pumping - stop select | 60.0 | 40.8 | 1.9 | 11.0 | 38.2 | 48.2 |
| var. speeds | 54.1 | 61.2 | 3.9 | 8.0 | 42.0 | 30.7 |
| Aut. handling equip. - ores | 54.1 | 62.1 | 8.2 | 4.4 | 37.7 | 33.5 |
| slurries | 62.4 | 53.8 | 2.5 | 9.8 | 35.1 | 36.4 |
| concentrates | 42.6 | 48.8 | 8.5 | 4.2 | 48.9 | 47.0 |
| reagents | 49.9 | 51.9 | 12.5 | 8.7 | 37.6 | 39.4 |
| Computer controlled vehicle & equip. | 25.1 | 36.3 | 14.7 | 7.3 | 60.2 | 56.4 |
| Comp. based vehicle & equip. maintenance | 48.5 | 57.4 | 7.5 | 11.4 | 44.1 | 31.2 |
| COMMUNICATIONS & NETWORKS | | | | | | |
| Radio based voice networks - open pit | 32.6 | 65.8 | 0.1 | 0.6 | 67.2 | 33.6 |
| underground | 34.9 | 38.1 | 6.8 | 3.5 | 58.4 | 58.4 |
| Data communication networks - open pit | 10.2 | 41.4 | 4.0 | 6.1 | 85.8 | 52.5 |
| Underground data communication networks | 44.8 | 26.2 | 8.1 | 11.2 | 47.1 | 62.7 |
| In plant data networks linking aut. proc. | 54.0 | 59.8 | 13.7 | 15.3 | 32.3 | 24.9 |
| CONTROL | | | | | | |
| Analog controllers | 63.8 | 77.1 | 1.0 | 1.7 | 35.3 | 21.1 |
| Programmable logic controllers (PLC) | 68.7 | 86.2 | 8.9 | 6.8 | 22.5 | 7.0 |
| On-line statistical process control | 19.2 | 38.0 | 28.9 | 30.3 | 51.9 | 31.7 |
| Supervisory control & data acquisition | 45.5 | 54.5 | 8.7 | 11.7 | 45.8 | 33.8 |
| Int. expert systems for process control | 15.9 | 42.4 | 22.2 | 20.4 | 62.0 | 37.1 |
| Aut. environmental monitoring & control | 51.7 | 57.6 | 7.1 | 12.3 | 41.2 | 30.2 |
| Automated T.V. image analysis | 10.5 | 27.8 | 0.9 | 5.5 | 88.6 | 66.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | |
| Near-stream analysis | 13.7 | 36.5 | 3.1 | 2.2 | 83.3 | 61.2 |
| On-stream analysis (XRF) | 38.5 | 59.8 | 10.4 | 7.8 | 51.1 | 32.3 |
| On-stream size analysis | 27.9 | 31.3 | 5.0 | 13.8 | 67.1 | 54.9 |
| Flow density measurement | 73.0 | 73.8 | 6.3 | 6.1 | 20.7 | 20.1 |
| Inventory measurement | 39.5 | 41.4 | 10.7 | 11.4 | 49.8 | 47.2 |

**TABLE 29.1 THE USE OF TECHNOLOGY BY OWNERSHIP OF MINING OPERATION (WEIGHTED BY MINES)**

| Technologies | Currently use | | | Plan to use | | | No plan to use | | |
|---|---|---|---|---|---|---|---|---|---|
| | % | | | % | | | % | | |
| | owner | | | owner | | | owner | | |
| | Canada | U.S. | Other | Canada | U.S. | Other | Canada | U.S. | Other |
| AUTOMATED MATERIAL HANDLING | | | | | | | | | |
| Automatic bin level measurement | 46.6 | 46.2 | 51.6 | 5.6 | - | 6.5 | 47.8 | 53.8 | 41.9 |
| Aut. conveyor - sequential analog | 36.0 | 19.2 | 45.2 | 2.8 | - | 3.2 | 61.2 | 80.8 | 51.6 |
| - computer control | 29.8 | 19.2 | 16.1 | 6.7 | 7.7 | 16.1 | 63.5 | 73.1 | 67.7 |
| Aut. slurry pumping - stop select | 32.6 | 30.8 | 32.3 | 3.9 | 3.8 | 16.1 | 63.5 | 65.4 | 51.6 |
| - var. speeds | 30.3 | 19.2 | 35.5 | 8.4 | 7.7 | 16.1 | 61.2 | 73.1 | 48.4 |
| Aut. handling equip. - ores | 28.1 | 26.9 | 22.6 | 6.7 | - | 12.9 | 65.2 | 73.1 | 64.5 |
| - slurries | 27.0 | 26.9 | 25.8 | 7.3 | - | 9.7 | 65.7 | 73.1 | 64.5 |
| - concentrates | 21.3 | 26.9 | 16.1 | 6.2 | - | 12.9 | 72.5 | 73.1 | 71.0 |
| - reagents | 20.8 | 23.1 | 35.5 | 10.1 | 3.8 | 16.1 | 69.1 | 73.1 | 48.4 |
| Computer controlled vehicle & equip | 13.5 | 23.1 | 3.2 | 10.7 | 3.8 | 16.1 | 75.8 | 73.1 | 80.6 |
| Comp. based vehicle & equip. maintenance | 29.8 | 30.8 | 25.8 | 9.6 | 19.2 | 19.4 | 60.7 | 50.0 | 54.8 |
| COMMUNICATIONS & NETWORKS | | | | | | | | | |
| Radio based voice networks - open pit | 31.5 | 46.2 | 38.7 | 1.7 | - | 3.2 | 66.9 | 53.8 | 58.1 |
| - underground | 16.3 | 23.1 | 16.1 | 8.4 | - | 9.7 | 75.3 | 76.9 | 74.2 |
| Data communication networks - open pit | 9.0 | 15.4 | 6.5 | 2.8 | 3.8 | 9.7 | 88.2 | 80.8 | 83.9 |
| Underground data communication networks | 15.2 | 19.2 | 16.1 | 7.9 | 3.8 | 9.7 | 77.0 | 76.9 | 74.2 |
| In plant data networks linking aut. proc. | 23.6 | 26.9 | 38.7 | 10.1 | 19.2 | 6.5 | 66.3 | 53.8 | 54.8 |
| CONTROL | | | | | | | | | |
| Analog controllers | 46.1 | 46.2 | 38.7 | 4.5 | - | 6.5 | 49.4 | 53.8 | 54.8 |
| Programmable logic controllers (PLC) | 50.0 | 53.8 | 54.8 | 9.6 | 11.5 | 9.7 | 40.4 | 34.6 | 35.5 |
| On-line statistical process control | 15.7 | 15.4 | 12.9 | 19.1 | 7.7 | 9.7 | 65.2 | 76.9 | 77.4 |
| Supervisory control & data acquisition | 21.9 | 23.1 | 22.6 | 12.4 | - | 16.1 | 65.7 | 76.9 | 61.3 |
| Int. expert systems for process control | 9.6 | 7.7 | 22.6 | 9.6 | 15.4 | 19.4 | 80.9 | 76.9 | 58.1 |
| Aut. environmental monitoring & control | 24.7 | 23.1 | 29.0 | 8.4 | 3.8 | 16.1 | 66.9 | 73.1 | 54.8 |
| Automated T.V. image analysis | 6.2 | 19.2 | 12.9 | 3.4 | - | 9.7 | 90.4 | 80.8 | 77.4 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | | | |
| Near-stream analysis | 11.8 | 11.5 | 12.9 | 5.1 | 3.8 | 3.2 | 83.1 | 84.6 | 83.9 |
| On-stream analysis (XRF) | 21.3 | 23.1 | 25.8 | 7.9 | 3.8 | 3.2 | 70.8 | 73.1 | 71.0 |
| On-stream size analysis | 6.7 | 19.2 | 12.9 | 7.9 | - | 6.5 | 85.4 | 80.8 | 80.6 |
| Flow density measurement | 39.3 | 57.7 | 41.9 | 8.4 | - | 12.9 | 52.2 | 42.3 | 45.2 |
| Inventory measurement | 21.3 | 38.5 | 22.6 | 6.7 | 7.7 | 6.5 | 71.9 | 53.8 | 71.0 |

TABLE 29.2 THE USE OF TECHNOLOGY BY OWNERSHIP OF MINING OPERATION (WEIGHTED BY EMPLOYEES)

| Technologies | Currently use | | | Plan to use | | | No plan to use | | |
|---|---|---|---|---|---|---|---|---|---|
| | % | | | % | | | % | | |
| | owner | | | owner | | | owner | | |
| | Canada | U.S. | Other | Canada | U.S. | Other | Canada | U.S. | Other |
| AUTOMATED MATERIAL HANDLING | | | | | | | | | |
| Automatic bin level measurement | 82.0 | 54.3 | 72.6 | 2.1 | - | 5.0 | 15.9 | 45.7 | 22.3 |
| Aut. conveyor - sequential analog | 61.2 | 38.1 | 70.4 | 1.9 | - | 0.3 | 36.9 | 61.9 | 29.3 |
| - computer controled | 61.2 | 22.6 | 46.9 | 8.6 | 2.8 | 5.4 | 30.1 | 74.6 | 47.8 |
| Aut. slurry pumping - stop select | 58.3 | 29.6 | 39.2 | 2.1 | 2.4 | 33.7 | 39.6 | 68.0 | 27.1 |
| - var. speeds | 62.0 | 31.9 | 65.8 | 7.6 | 4.1 | 6.3 | 30.4 | 64.0 | 27.9 |
| Aut. handling equip. - ores | 61.3 | 63.4 | 41.1 | 7.5 | - | 7.6 | 31.2 | 36.6 | 51.3 |
| - slurries | 60.7 | 65.6 | 36.4 | 6.9 | - | 5.6 | 32.4 | 34.4 | 58.0 |
| - concentrates | 53.5 | 47.3 | 15.8 | 6.8 | - | 8.4 | 39.7 | 52.7 | 75.8 |
| - reagents | 50.6 | 41.6 | 71.8 | 12.4 | 4.7 | 10.6 | 37.0 | 53.6 | 17.7 |
| Computer controled vehicle & equip. | 35.3 | 57.7 | 0.3 | 12.7 | 1.1 | 6.7 | 52.0 | 41.3 | 93.0 |
| Comp. based vehicle & equip. maintenance | 49.0 | 53.9 | 59.5 | 6.6 | 28.5 | 7.4 | 44.4 | 17.6 | 33.1 |
| COMMUNICATIONS & NETWORKS | | | | | | | | | |
| Radio base voice networks - open pit | 50.3 | 69.3 | 30.1 | 0.4 | - | 0.3 | 49.3 | 30.7 | 69.6 |
| - underground | 38.7 | 32.2 | 51.8 | 5.4 | - | 5.5 | 55.8 | 67.8 | 42.7 |
| Data communication networks - open pit | 25.1 | 28.3 | 12.9 | 5.7 | 1.1 | 2.6 | 69.2 | 70.7 | 84.5 |
| Underground data communication networks | 40.3 | 39.8 | 14.0 | 6.6 | 1.7 | 30.3 | 53.1 | 58.4 | 55.7 |
| In plant data networks linking aut. proc. | 57.2 | 35.6 | 77.8 | 10.4 | 45.7 | 0.9 | 32.3 | 18.8 | 21.4 |
| CONTROL | | | | | | | | | |
| Analog controllers | 77.9 | 43.3 | 67.1 | 2.0 | - | 5.2 | 20.1 | 56.7 | 27.7 |
| Programmable logic controllers (PLC) | 81.2 | 67.7 | 66.8 | 9.6 | 1.6 | 12.1 | 9.2 | 30.7 | 21.1 |
| On-line statistical process control | 30.7 | 36.3 | 18.9 | 30.6 | 10.4 | 28.9 | 38.7 | 53.2 | 52.1 |
| Supervisory control & data aquisition | 51.8 | 33.9 | 66.6 | 11.7 | - | 10.1 | 36.6 | 66.1 | 23.3 |
| Int. expert systems for process control | 28.6 | 25.8 | 48.2 | 16.8 | 35.9 | 18.3 | 54.6 | 38.4 | 33.6 |
| Aut. environmental monitoring & control | 59.1 | 31.7 | 64.5 | 6.3 | 20.1 | 14.2 | 34.6 | 48.3 | 21.3 |
| Automated T.V. image analysis | 16.6 | 41.6 | 8.3 | 3.9 | - | 1.4 | 79.5 | 58.4 | 90.2 |
| AUTOMATED PROCESSING SYSTEMS | | | | | | | | | |
| Near-stream analysis | 22.4 | 36.3 | 24.3 | 2.7 | 4.7 | 0.3 | 74.9 | 58.9 | 75.4 |
| On-stream analysis (XRF) | 49.5 | 48.2 | 65.4 | 10.4 | 5.7 | 0.3 | 40.1 | 46.1 | 34.3 |
| On-stream size analysis | 25.0 | 55.9 | 14.8 | 11.7 | - | 28.4 | 63.3 | 44.1 | 56.8 |
| Flow density measurement | 73.0 | 87.2 | 66.7 | 6.5 | - | 13.5 | 20.5 | 12.8 | 19.9 |
| Inventory measurement | 39.6 | 60.5 | 32.8 | 8.7 | 2.1 | 28.4 | 51.7 | 37.4 | 38.8 |

TABLE 30.1 THE USE OF TECHNOLOGY BY AGE OF OPERATION (WEIGHTED BY MINES)

| Technologies | Currently use | | | | |
|---|---|---|---|---|---|
| | % | | | | |
| | years | | | | |
| | 0- 5 | 6-10 | 11-15 | 16-20 | > 20 |
| AUTOMATED MATERIAL HANDLING | | | | | |
| Automatic bin level measurement | 34.2 | 44.8 | 41.2 | 72.2 | 54.1 |
| Aut. conveyor - sequential analog | 20.5 | 31.0 | 41.2 | 66.7 | 40.8 |
| - computer control | 20.5 | 34.5 | 17.6 | 33.3 | 29.6 |
| Aut. slurry pumping - stop select | 27.4 | 41.4 | 23.5 | 50.0 | 31.6 |
| - var. speeds | 24.7 | 37.9 | 29.4 | 44.4 | 28.6 |
| Aut. handling equip. - ores | 19.2 | 34.5 | 29.4 | 44.4 | 27.6 |
| - slurries | 21.9 | 44.8 | 23.5 | 38.9 | 23.5 |
| - concentrates | 13.7 | 20.7 | 29.4 | 22.2 | 25.5 |
| - reagents | 17.8 | 31.0 | 23.5 | 33.3 | 22.4 |
| Computer controlled vehicle & equipment | 5.5 | 24.1 | 17.6 | 16.7 | 14.3 |
| Comp. based vehicle & equip. maintenance | 26.0 | 31.0 | 29.4 | 44.4 | 28.6 |
| COMMUNICATIONS & NETWORKS | | | | | |
| Radio based voice networks - open pit | 20.5 | 31.0 | 23.5 | 72.2 | 39.8 |
| - underground | 9.6 | 24.1 | 17.6 | 5.6 | 22.4 |
| Data communication networks - open pit | 2.7 | 17.2 | - | 22.2 | 11.2 |
| Underground data communication networks | 12.3 | 27.6 | 17.6 | - | 17.3 |
| In plant data networks linking aut. processes | 16.4 | 34.5 | 29.4 | 38.9 | 27.6 |
| CONTROL | | | | | |
| Analog controllers | 35.6 | 44.8 | 41.2 | 55.6 | 51.0 |
| Programmable logic controllers (PLC) | 41.1 | 58.6 | 41.2 | 44.4 | 59.2 |
| On-line statistical process control | 9.6 | 24.1 | 17.6 | 11.1 | 17.3 |
| Supervisory control & data acquisition | 19.2 | 20.7 | 11.8 | 33.3 | 24.5 |
| Int. expert systems for process control | 6.8 | 10.3 | 17.6 | 11.1 | 13.3 |
| Aut. environmental monitoring & control | 20.5 | 27.6 | 29.4 | 22.2 | 27.6 |
| Automated T.V. image analysis | 5.5 | 3.4 | 11.8 | 5.6 | 12.2 |
| AUTOMATED PROCESSING SYSTEMS | | | | | |
| Near-stream analysis | 8.2 | 20.7 | 11.8 | 16.7 | 11.2 |
| On-stream analysis (XRF) | 13.7 | 20.7 | 17.6 | 38.9 | 26.5 |
| On-stream size analysis | 4.1 | 6.9 | 11.8 | 22.2 | 10.2 |
| Flow density measurement | 35.6 | 44.8 | 29.4 | 44.4 | 46.9 |
| Inventory measurement | 17.8 | 27.6 | 17.6 | 27.8 | 26.5 |

TABLE 30.2 THE USE OF TECHNOLOGY BY AGE OF OPERATION (WEIGHTED BY EMPLOYEES)

| Technologies | Currently use | | | | |
|---|---|---|---|---|---|
| | % | | | | |
| | years | | | | |
| | 0- 5 | 6-10 | 11-15 | 16-20 | > 20 |
| AUTOMATED MATERIAL HANDLING | | | | | |
| Automatic bin level measurement | 57.2 | 80.2 | 45.4 | 88.0 | 81.0 |
| Aut. conveyor - sequential analog | 40.7 | 44.8 | 50.9 | 88.9 | 61.8 |
| - computer control | 35.6 | 71.0 | 37.6 | 58.9 | 55.3 |
| Aut. slurry pumping - stop select | 48.1 | 75.6 | 41.9 | 88.4 | 44.4 |
| - var. speeds | 38.3 | 52.9 | 47.8 | 85.7 | 60.2 |
| Aut. handling equip. - ores | 37.8 | 60.3 | 60.6 | 69.6 | 61.6 |
| - slurries | 44.6 | 78.0 | 29.9 | 68.1 | 58.3 |
| - concentrates | 23.9 | 41.6 | 43.3 | 44.0 | 54.7 |
| - reagents | 33.9 | 35.9 | 54.7 | 58.3 | 57.4 |
| Computer controlled vehicle & equipment | 12.2 | 39.6 | 35.9 | 37.2 | 36.9 |
| Comp. based vehicle & equip. maintenance | 40.9 | 54.9 | 60.6 | 65.3 | 49.8 |
| COMMUNICATIONS & NETWORKS | | | | | |
| Radio based voice networks - open pit | 23.5 | 51.1 | 13.2 | 93.1 | 52.4 |
| - underground | 16.1 | 33.8 | 28.0 | 4.4 | 50.7 |
| Data communication networks - open pit | 3.6 | 35.7 | - | 34.7 | 26.3 |
| Underground data communication networks | 13.1 | 43.6 | 29.5 | - | 46.1 |
| In plant data networks linking aut. proc. | 33.8 | 67.8 | 44.4 | 66.4 | 59.0 |
| CONTROL | | | | | |
| Analog controllers | 59.1 | 51.0 | 70.9 | 88.1 | 75.7 |
| Programmable logic controllers (PLC) | 58.8 | 90.8 | 51.9 | 66.0 | 82.2 |
| On-line statistical process control | 14.0 | 32.9 | 24.0 | 5.9 | 36.3 |
| Supervisory control & data acquisition | 38.0 | 31.5 | 18.0 | 58.9 | 58.3 |
| Int. expert systems for process control | 10.4 | 11.1 | 18.1 | 7.7 | 42.0 |
| Aut. environmental monitoring & control | 40.5 | 50.3 | 51.6 | 42.8 | 62.1 |
| Automated T.V. image analysis | 9.7 | 2.4 | 30.0 | 15.3 | 23.6 |
| AUTOMATED PROCESSING SYSTEMS | | | | | |
| Near-stream analysis | 6.4 | 34.4 | 30.0 | 20.5 | 26.7 |
| On-stream analysis (XRF) | 20.1 | 34.8 | 35.7 | 53.8 | 61.1 |
| On-stream size analysis | 5.8 | 12.1 | 22.1 | 36.9 | 34.4 |
| Flow density measurement | 56.9 | 76.1 | 48.8 | 81.1 | 78.1 |
| Inventory measurement | 28.8 | 39.3 | 18.1 | 25.4 | 48.4 |

**TABLE 30.3 PLAN TO USE TECHNOLOGY BY AGE OF OPERATION (WEIGHTED BY MINES)**

| Technologies | Plan to use | | | | |
|---|---|---|---|---|---|
| | % | | | | |
| | years | | | | |
| | 0- 5 | 6-10 | 11-15 | 16-20 | > 20 |
| AUTOMATED MATERIAL HANDLING | | | | | |
| Automatic bin level measurement | 9.6 | 3.4 | - | - | 4.1 |
| Aut. conveyor - sequential analog | 2.7 | 3.4 | 5.9 | - | 2.0 |
| - computer control | 5.5 | 3.4 | 17.6 | 5.6 | 10.2 |
| Aut. slurry pumping - stop select | 5.5 | 6.9 | 5.9 | - | 6.1 |
| - var. speeds | 11.0 | 6.9 | 17.6 | 5.6 | 8.2 |
| Aut. handling equip. - ores | 6.8 | 10.3 | - | 5.6 | 7.1 |
| - slurries | 9.6 | 6.9 | 5.9 | - | 6.1 |
| - concentrates | 8.2 | 6.9 | 5.9 | 5.6 | 5.1 |
| - reagents | 13.7 | 13.8 | 5.9 | 5.6 | 8.2 |
| Computer controlled vehicle & equipment | 12.3 | 10.3 | - | 11.1 | 11.2 |
| Comp. based vehicle & equip. maintenance | 9.6 | 3.4 | 11.8 | 11.1 | 16.3 |
| COMMUNICATIONS & NETWORKS | | | | | |
| Radio based voice networks - open pit | 2.7 | - | - | - | 2.0 |
| - underground | 16.4 | 3.4 | 5.9 | - | 4.1 |
| Data communication networks - open pit | 2.7 | 3.4 | - | 16.7 | 3.1 |
| Underground data communication networks | 9.6 | 10.3 | - | - | 8.2 |
| In plant data networks linking aut. processes | 9.6 | 3.4 | 11.8 | 5.6 | 14.3 |
| CONTROL | | | | | |
| Analog controllers | 4.1 | 6.9 | - | 5.6 | 4.1 |
| Programmable logic controllers (PLC) | 8.2 | 10.3 | 11.8 | 16.7 | 9.2 |
| On-line statistical process control | 12.3 | 17.2 | 17.6 | 27.8 | 17.3 |
| Supervisory control & data acquisition | 12.3 | 13.8 | 17.6 | 22.2 | 7.1 |
| Int. expert systems for process control | 9.6 | 10.3 | 5.9 | 38.9 | 9.2 |
| Aut. environmental monitoring & control | 9.6 | 10.3 | - | 16.7 | 8.2 |
| Automated T.V. image analysis | 2.7 | 3.4 | 11.8 | 11.1 | 2.0 |
| AUTOMATED PROCESSING SYSTEMS | | | | | |
| Near-stream analysis | 5.5 | 10.3 | 11.8 | - | 2.0 |
| On-stream analysis (XRF) | 6.8 | 10.3 | 11.8 | 11.1 | 4.1 |
| On-stream size analysis | 4.1 | 10.3 | 11.8 | 11.1 | 6.1 |
| Flow density measurement | 4.1 | 10.3 | 23.5 | 11.1 | 7.1 |
| Inventory measurement | 2.7 | 10.3 | 5.9 | 11.1 | 8.2 |

**TABLE 30.4 PLAN TO USE TECHNOLOGY BY AGE OF OPERATION (WEIGHTED BY EMPLOYEES)**

| Technologies | Plan to use | | | | |
|---|---|---|---|---|---|
| | % | | | | |
| | years | | | | |
| | 0- 5 | 6-10 | 11-15 | 16-20 | > 20 |
| AUTOMATED MATERIAL HANDLING | | | | | |
| Automatic bin level measurement | 12.0 | 0.5 | - | - | 1.0 |
| Aut. conveyor - sequential analog | 2.3 | 3.3 | 8.9 | - | 0.6 |
| - computer control | 13.9 | 0.5 | 11.4 | 0.8 | 7.9 |
| Aut. slurry pumping - stop select | 7.9 | 2.6 | 1.7 | - | 7.4 |
| - var. speeds | 16.2 | 2.6 | 11.0 | 4.4 | 5.9 |
| Aut. handling equip. - ores | 14.8 | 7.3 | - | 0.8 | 5.8 |
| - slurries | 17.4 | 3.3 | 1.7 | - | 5.0 |
| - concentrates | 15.0 | 3.3 | 1.7 | 5.6 | 5.1 |
| - reagents | 22.8 | 29.5 | 1.7 | 5.6 | 6.9 |
| Computer controlled vehicle & equipment | 15.9 | 6.4 | - | 6.4 | 11.1 |
| Comp. based vehicle & equip. maintenance | 7.2 | 0.5 | 2.5 | 2.3 | 13.3 |
| COMMUNICATIONS & NETWORKS | | | | | |
| Radio based voice networks - open pit | 1.8 | - | - | - | 0.1 |
| - underground | 27.5 | 0.5 | 5.7 | - | 1.4 |
| Data communication networks - open pit | 3.3 | 0.5 | - | 39.5 | 1.2 |
| Underground data communication networks | 15.4 | 4.0 | - | - | 10.2 |
| In plant data networks linking aut. proc. | 17.3 | 0.5 | 8.0 | 0.8 | 18.0 |
| CONTROL | | | | | |
| Analog controllers | 4.7 | 5.4 | - | 0.5 | 1.4 |
| Programmable logic controllers (PLC) | 16.4 | 5.9 | 21.3 | 20.2 | 5.4 |
| On-line statistical process control | 21.8 | 25.9 | 2.7 | 39.9 | 29.1 |
| Supervisory control & data acquisition | 17.3 | 5.8 | 22.5 | 28.5 | 5.7 |
| Int. expert systems for process control | 16.9 | 10.5 | 0.9 | 54.1 | 18.3 |
| Aut. environmental monitoring & control | 14.0 | 10.5 | - | 15.2 | 7.8 |
| Automated T.V. image analysis | 3.0 | 2.7 | 2.1 | 21.8 | 0.6 |
| AUTOMATED PROCESSING SYSTEMS | | | | | |
| Near-stream analysis | 8.2 | 7.8 | 1.9 | - | 1.1 |
| On-stream analysis (XRF) | 12.3 | 23.3 | 8.4 | 32.9 | 1.8 |
| On-stream size analysis | 6.8 | 11.0 | 13.6 | 20.3 | 12.3 |
| Flow density measurement | 5.1 | 5.4 | 28.0 | 10.0 | 5.0 |
| Inventory measurement | 2.2 | 2.9 | 1.5 | 15.8 | 13.0 |

**TABLE 30.5 NO PLAN TO USE TECHNOLOGY BY AGE OF OPERATION (WEIGHTED BY MINES)**

| Technologies | No plan to use | | | | |
|---|---|---|---|---|---|
| | % | | | | |
| | years | | | | |
| | 0- 5 | 6-10 | 11-15 | 16-20 | > 20 |
| AUTOMATED MATERIAL HANDLING | | | | | |
| Automatic bin level measurement | 56.2 | 51.7 | 58.8 | 27.8 | 41.8 |
| Aut. conveyor - sequential analog | 76.7 | 65.5 | 52.9 | 33.3 | 57.1 |
| - computer control | 74.0 | 62.1 | 64.7 | 61.1 | 60.2 |
| Aut. slurry pumping - stop select | 67.1 | 51.7 | 70.6 | 50.0 | 62.2 |
| - var. speeds | 64.4 | 55.2 | 52.9 | 50.0 | 63.3 |
| Aut. handling equip. - ores | 74.0 | 55.2 | 70.6 | 50.0 | 65.3 |
| - slurries | 68.5 | 48.3 | 70.6 | 61.1 | 70.4 |
| - concentrates | 78.1 | 72.4 | 64.7 | 72.2 | 69.4 |
| - reagents | 68.5 | 55.2 | 70.6 | 61.1 | 69.4 |
| Computer controlled vehicle & equipment | 82.2 | 65.5 | 82.4 | 72.2 | 74.5 |
| Comp. based vehicle & equip. maintenance | 64.4 | 65.5 | 58.8 | 44.4 | 55.1 |
| COMMUNICATIONS & NETWORKS | | | | | |
| Radio based voice networks - open pit | 76.7 | 69.0 | 76.5 | 27.8 | 58.2 |
| - underground | 74.0 | 72.4 | 76.5 | 94.4 | 73.5 |
| Data communication networks - open pit | 94.5 | 79.3 | 100.0 | 61.1 | 85.7 |
| Underground data communication networks | 78.1 | 62.1 | 82.4 | 100.0 | 74.5 |
| In plant data networks linking aut. processes | 74.0 | 62.1 | 58.8 | 55.6 | 58.2 |
| CONTROL | | | | | |
| Analog controllers | 60.3 | 48.3 | 58.8 | 38.9 | 44.9 |
| Programmable logic controllers (PLC) | 50.7 | 31.0 | 47.1 | 38.9 | 31.6 |
| On-line statistical process control | 78.1 | 58.6 | 64.7 | 61.1 | 65.3 |
| Supervisory control & data acquisition | 68.5 | 65.5 | 70.6 | 44.4 | 68.4 |
| Int. expert systems for process control | 83.6 | 79.3 | 76.5 | 50.0 | 77.6 |
| Aut. environmental monitoring & control | 69.9 | 62.1 | 70.6 | 61.1 | 64.3 |
| Automated T.V. image analysis | 91.8 | 93.1 | 76.5 | 83.3 | 85.7 |
| AUTOMATED PROCESSING SYSTEMS | | | | | |
| Near-stream analysis | 86.3 | 69.0 | 76.5 | 83.3 | 86.7 |
| On-stream analysis (XRF) | 79.5 | 69.0 | 70.6 | 50.0 | 69.4 |
| On-stream size analysis | 91.8 | 82.8 | 76.5 | 66.7 | 83.7 |
| Flow density measurement | 60.3 | 44.8 | 47.1 | 44.4 | 45.9 |
| Inventory measurement | 79.5 | 62.1 | 76.5 | 61.1 | 65.3 |

**TABLE 30.6 NO PLAN TO USE TECHNOLOGY BY AGE OF OPERATION (WEIGHTED BY EMPLOYEES)**

| Technologies | No plan to use | | | | |
|---|---|---|---|---|---|
| | % | | | | |
| | years | | | | |
| | 0- 5 | 6-10 | 11-15 | 16-20 | > 20 |
| AUTOMATED MATERIAL HANDLING | | | | | |
| Automatic bin level measurement | 30.8 | 19.3 | 54.6 | 12.0 | 18.0 |
| Aut. conveyor - sequential analog | 57.1 | 51.8 | 40.2 | 11.1 | 37.6 |
| - computer control | 50.5 | 28.6 | 51.0 | 40.3 | 36.7 |
| Aut. slurry pumping - stop select | 43.9 | 21.8 | 56.5 | 11.6 | 48.2 |
| - var. speeds | 45.6 | 44.4 | 41.3 | 9.9 | 33.8 |
| Aut. handling equip. - ores | 47.4 | 32.4 | 39.4 | 29.6 | 32.5 |
| - slurries | 38.0 | 18.7 | 68.4 | 31.9 | 36.8 |
| - concentrates | 61.1 | 55.1 | 55.0 | 50.4 | 40.2 |
| - reagents | 43.4 | 34.7 | 43.6 | 36.1 | 35.6 |
| Computer controlled vehicle & equipment | 72.0 | 53.9 | 64.1 | 56.3 | 52.0 |
| Comp. based vehicle & equip. maintenance | 51.9 | 44.6 | 36.9 | 32.4 | 36.9 |
| COMMUNICATIONS & NETWORKS | | | | | |
| Radio based voice networks - open pit | 74.7 | 48.9 | 86.8 | 6.9 | 47.4 |
| - underground | 56.4 | 65.7 | 66.3 | 95.6 | 48.0 |
| Data communication networks - open pit | 93.1 | 63.7 | 100.0 | 25.9 | 72.5 |
| Underground data communication networks | 71.5 | 52.4 | 70.5 | 100.0 | 43.7 |
| In plant data networks linking aut. proc. | 48.9 | 31.7 | 47.6 | 32.8 | 22.9 |
| CONTROL | | | | | |
| Analog controllers | 36.2 | 43.6 | 29.1 | 11.4 | 22.9 |
| Programmable logic controllers (PLC) | 24.8 | 3.4 | 26.8 | 13.8 | 12.3 |
| On-line statistical process control | 64.2 | 41.2 | 73.2 | 54.2 | 34.6 |
| Supervisory control & data acquisition | 44.7 | 62.7 | 59.4 | 12.6 | 36.0 |
| Int. expert systems for process control | 72.7 | 78.4 | 81.1 | 38.1 | 39.7 |
| Aut. environmental monitoring & control | 45.4 | 39.1 | 48.4 | 41.9 | 30.1 |
| Automated T.V. image analysis | 87.3 | 94.9 | 67.9 | 62.9 | 75.8 |
| AUTOMATED PROCESSING SYSTEMS | | | | | |
| Near-stream analysis | 85.5 | 57.8 | 68.1 | 79.5 | 72.2 |
| On-stream analysis (XRF) | 67.6 | 42.0 | 55.9 | 13.3 | 37.0 |
| On-stream size analysis | 87.5 | 77.0 | 64.3 | 42.9 | 53.3 |
| Flow density measurement | 38.0 | 18.6 | 23.2 | 8.9 | 16.9 |
| Inventory measurement | 69.0 | 57.8 | 80.5 | 58.8 | 38.6 |

TABLE 31.1 IMPACT ON OUTPUT

| | no. | % |
|---|---|---|
| OUTPUT | | |
| Increase | 109 | 63.4 |
| Decrease | - | - |
| No Change | 63 | 36.6 |
| ALL | 172 | 100.0 |

TABLE 31.2 IMPACT ON PRODUCT QUALITY

| | no. | % |
|---|---|---|
| QUALITY | | |
| Increase | 97 | 56.1 |
| Decrease | 1 | 0.6 |
| No Change | 75 | 43.4 |
| ALL | 173 | 100.0 |

TABLE 31.3 IMPACT ON COSTS

| | no. | % |
|---|---|---|
| COSTS | | |
| Increase | 15 | 8.9 |
| Decrease | 109 | 64.5 |
| No Change | 45 | 26.6 |
| ALL | 169 | 100.0 |

TABLE 31.4 IMPACT ON OUTPUT BY INDUSTRY

| | OUTPUT | | | | | |
|---|---|---|---|---|---|---|
| | Increase | | Decrease | | No Change | |
| | no. | % | no. | % | no. | % |
| Gold Mines | 33 | 57.9 | - | - | 24 | 42.1 |
| Copper and Copper-Zinc Mines | 16 | 88.9 | - | - | 2 | 11.1 |
| Nickel-Copper Mines | 3 | 60.0 | - | - | 2 | 40.0 |
| Silver-Lead-Zinc Mines | 7 | 87.5 | - | - | 1 | 12.5 |
| Uranium Mines | 4 | 57.1 | - | - | 3 | 42.9 |
| Iron Mines | 8 | 100.0 | - | - | - | - |
| Other Metal Mines | 4 | 100.0 | - | - | - | - |
| Asbestos Mines | 1 | 33.3 | - | - | 2 | 66.7 |
| Gypsum Mines | 6 | 60.0 | - | - | 4 | 40.0 |
| Potash Mines | 7 | 70.0 | - | - | 3 | 30.0 |
| Salt Mines | 6 | 54.5 | - | - | 5 | 45.5 |
| Other Non-Metal Mines (except coal) | 6 | 37.5 | - | - | 10 | 62.5 |
| Coal Mines | 8 | 53.3 | - | - | 7 | 46.7 |
| ALL | 109 | 63.4 | - | - | 63 | 36.6 |

TABLE 31.5 IMPACT ON PRODUCT QUALITY BY INDUSTRY

| | PRODUCT QUALITY | | | | | |
|---|---|---|---|---|---|---|
| | Increase | | Decrease | | No Change | |
| | no. | % | no. | % | no. | % |
| Gold Mines | 22 | 37.9 | 1 | 1.7 | 35 | 60.3 |
| Copper and Copper-Zinc Mines | 14 | 77.8 | - | - | 4 | 22.2 |
| Nickel-Copper Mines | 5 | 100.0 | - | - | - | - |
| Silver-Lead-Zinc Mines | 6 | 75.0 | - | - | 2 | 25.0 |
| Uranium Mines | 5 | 71.4 | - | - | 2 | 28.6 |
| Iron Mines | 8 | 100.0 | - | - | - | - |
| Other Metal Mines | 3 | 75.0 | - | - | 1 | 25.0 |
| Asbestos Mines | 2 | 66.7 | - | - | 1 | 33.3 |
| Gypsum Mines | 5 | 50.0 | - | - | 5 | 50.0 |
| Potash Mines | 6 | 60.0 | - | - | 4 | 40.0 |
| Salt Mines | 6 | 54.5 | - | - | 5 | 45.5 |
| Other Non-Metal Mines (except coal) | 6 | 37.5 | - | - | 10 | 62.5 |
| Coal Mines | 9 | 60.0 | - | - | 6 | 40.0 |
| ALL | 97 | 56.1 | 1 | 0.6 | 75 | 43.4 |

TABLE 31.6 IMPACT ON COSTS BY INDUSTRY

| | COSTS | | | | | |
|---|---|---|---|---|---|---|
| | Increase | | Decrease | | No Change | |
| | no. | % | no. | % | no. | % |
| Gold Mines | 6 | 10.9 | 28 | 50.9 | 21 | 38.2 |
| Copper and Copper-Zinc Mines | 1 | 5.8 | 15 | 88.2 | 1 | 5.9 |
| Nickel-Copper Mines | - | - | 4 | 80.0 | 1 | 20.0 |
| Silver-Lead-Zinc Mines | - | - | 8 | 100.0 | - | - |
| Uranium Mines | - | - | 6 | 85.7 | 1 | 14.3 |
| Iron Mines | - | - | 8 | 100.0 | - | - |
| Other Metal Mines | - | - | 2 | 50.0 | 2 | 50.0 |
| Asbestos Mines | - | - | 3 | 100.0 | - | - |
| Gypsum Mines | 2 | 22.2 | 6 | 66.7 | 1 | 11.1 |
| Potash Mines | - | - | 9 | 81.8 | 2 | 18.2 |
| Salt Mines | - | - | 6 | 54.6 | 5 | 45.5 |
| Other Non-Metal Mines (except coal) | 3 | 18.8 | 6 | 37.5 | 7 | 43.8 |
| Coal Mines | 3 | 20.0 | 8 | 53.3 | 4 | 26.7 |
| ALL | 15 | 8.9 | 109 | 64.5 | 45 | 26.6 |

**TABLE 31.7 IMPACT ON OUTPUT BY SIZE OF MINE**

| | OUTPUT | | | | | |
|---|---|---|---|---|---|---|
| | Increase | | Decrease | | No Change | |
| | no. | % | no. | % | no. | % |
| EMPLOYEES | | | | | | |
| 0 - 49 | 13 | 46.4 | - | - | 15 | 53.6 |
| 50-249 | 43 | 60.6 | - | - | 28 | 39.4 |
| > 249 | 53 | 72.6 | - | - | 20 | 27.4 |
| ALL | 109 | 63.4 | - | - | 63 | 36.6 |

**TABLE 31.8 IMPACT ON QUALITY BY SIZE OF MINE**

| | QUALITY | | | | | |
|---|---|---|---|---|---|---|
| | Increase | | Decrease | | No Change | |
| | no. | % | no. | % | no. | % |
| EMPLOYEES | | | | | | |
| 0 - 49 | 15 | 51.7 | - | - | 14 | 48.2 |
| 50-249 | 31 | 43.7 | 1 | 1.4 | 39 | 54.9 |
| > 249 | 51 | 69.9 | - | - | 22 | 30.1 |
| ALL | 97 | 56.1 | 1 | 0.6 | 75 | 43.4 |

**TABLE 31.9 IMPACT ON COSTS BY SIZE OF MINE**

| | COSTS | | | | | |
|---|---|---|---|---|---|---|
| | Increase | | Decrease | | No Change | |
| | no. | % | no. | % | no. | % |
| EMPLOYEES | | | | | | |
| 0 - 49 | 5 | 18.5 | 11 | 40.7 | 11 | 40.7 |
| 50-249 | 8 | 11.6 | 39 | 56.5 | 22 | 31.9 |
| > 249 | 2 | 2.7 | 59 | 80.8 | 12 | 16.4 |
| ALL | 15 | 8.9 | 109 | 64.5 | 45 | 26.6 |

# *Distribution Tables*

**TABLE 32.1 DISTRIBUTION BY INDUSTRY**

| Industries | no. | % |
|---|---|---|
| Gold Mines | 74 | 31.5 |
| Copper and Copper-Zinc Mines | 22 | 9.4 |
| Nickel-Copper Mines | 5 | 2.1 |
| Silver-Lead-Zinc Mines | 16 | 6.8 |
| Uranium Mines | 9 | 3.8 |
| Iron Mines | 8 | 3.4 |
| Other Metal Mines | 8 | 3.4 |
| Asbestos Mines | 4 | 1.7 |
| Gypsum Mines | 15 | 6.4 |
| Potash Mines | 11 | 4.7 |
| Salt Mines | 11 | 4.7 |
| Other Non-Metal Mines (except coal) | 33 | 14.0 |
| Coal Mines | 19 | 8.1 |
| ALL | 235 | 100.0 |

**TABLE 32.2 DISTRIBUTION BY PROVINCE**

| Province | no. | % |
|---|---|---|
| Newfoundland | 10 | 4.3 |
| Nova Scotia | 14 | 6.0 |
| New Brunswick | 8 | 3.4 |
| Quebec | 58 | 24.7 |
| Ontario | 53 | 22.6 |
| Manitoba | 8 | 3.4 |
| Saskatchewan | 25 | 10.6 |
| Alberta | 8 | 3.4 |
| British Columbia | 39 | 16.6 |
| Yukon | 4 | 1.7 |
| Northwest Territories | 8 | 3.4 |
| CANADA | 235 | 100.0 |

TABLE 32.3 DISTRIBUTION BY MINING METHOD

| Mining Method | no. | % |
|---|---|---|
| Selective | 115 | 53.5 |
| Bulk | 100 | 46.5 |
| ALL | 215 | 100.0 |

TABLE 32.4 DISTRIBUTION BY OWNERSHIP

| Owner | no. | % |
|---|---|---|
| Canada | 178 | 75.7 |
| U.S. | 26 | 11.1 |
| Other | 31 | 13.2 |
| CANADA | 235 | 100.0 |

TABLE 32.5 DISTRIBUTION BY SIZE OF OPERATION

| Number of employees | no. | % |
|---|---|---|
| 0 - 49 | 67 | 28.5 |
| 50 - 249 | 86 | 36.6 |
| 250 + | 82 | 34.9 |
| CANADA | 235 | 100.0 |

TABLE 32.6 DISTRIBUTION BY AGE OF OPERATION

| Age of Operation | no. | % |
|---|---|---|
| 0- 5 | 73 | 31.1 |
| 6-10 | 29 | 12.3 |
| 11-15 | 17 | 7.2 |
| 16-20 | 18 | 7.7 |
| > 20 | 98 | 41.7 |
| CANADA | 235 | 100.0 |

TABLE 33.1 QUESTIONNAIRES SENT

| | no. |
|---|---|
| QUESTIONNAIRES SENT | 324 |
| Inactive or ceased operation | 48 |
| Exploration only | 22 |
| In early stage of development | 8 |
| Non-response | 11 |
| USABLE QUESTIONNAIRES | 235 |